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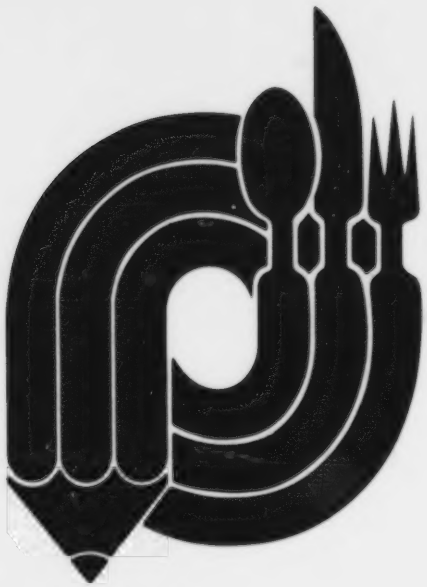
National Institutes of Health

PROGRAM IN BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING FISCAL YEAR 1980



NIH Nutrition
Coordinating Committee

U.S. DEPARTMENT OF
HEALTH AND HUMAN SERVICES
Public Health Service
National Institutes of Health

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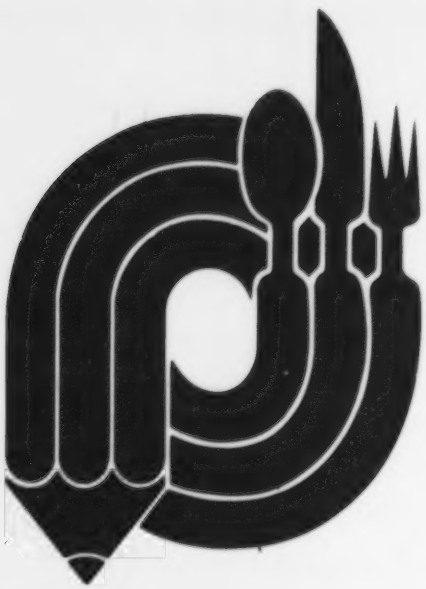
Annual Report of the
National Institutes of Health

PROGRAM IN BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING FISCAL YEAR 1980



Prepared by
NIH Nutrition
Coordinating Committee

U.S. DEPARTMENT OF
HEALTH AND HUMAN SERVICES
Public Health Service
National Institutes of Health

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THE MEMBERSHIP OF THE NUTRITION COORDINATING COMMITTEE*

Officers	
Chairman	Artemis P. Simopoulos, M.D.
Vice Chairman	Robert Edelman, M.D.
Consultant	Van Hubbard, M.D., Ph.D. (Intramural NIAMDD)
Members and (Alternates)	
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Division of Research Services	Joseph J. Knapka, Ph.D.
National Cancer Institute	Diane Fink, M.D.
National Eye Institute	Carolyn McHale (Ralph Helmsen, Ph.D.)
National Heart, Lung, and Blood Institute	Phyllis Eveleth, Ph.D. (Basil M. Rifkind, M.D.)
National Institute on Aging	Elizabeth A. McGuire, Ph.D. (Michael Dieter, Ph.D.)
National Institute of Allergy and Infectious Diseases	Robert Edelman, M.D. (Alfred M. Webb, Ph.D.)
National Institute of Arthritis, Metabolism, and Digestive Diseases	Gerald Combs, Ph.D. (John G. Bieri, Ph.D.)
National Institute of Child Health and Human Development	Gilman D. Grave, M.D. (Thorsten Fjellstedt, Ph.D.)
National Institute of Dental Research	David A. Wolff, Ph.D. (Paul D. Frazier, D.D.S., Ph.D.)
National Institute of Environmental Health Sciences	Wilford L. Nusser, Ph.D. (Carol M. Schiller, Ph.D.)
National Institute of General Medical Sciences	Emilie A. Black, M.D.

*(Alternates in Parenthesis)

As of September 8, 1980

National Institute of Neurological and Communicative Disorders and Stroke	Zekin Shakhashiri, M.D. (O. Malcolm Ray, Ph.D.)

NIH Liaison Representatives

Clinical Center	Elaine Offutt (Edith Jones)
Division of Computer Research and Technology	Penny Brogan (Arnold Pratt, M.D.)
Division of Legislative Analysis	Anne Houser
Division of Research Grants	John Schubert, Ph.D. (Julius A. Currie, Ph.D.)
Fogarty International Center	Earl Chamberlayne, D.V.M.
National Library of Medicine	Harold Schoolman, M.D.
Office of Communication	Marc Stern

PHS, Department, and Other Liaison

Alcohol, Drug Abuse, and Mental Health Administration	Ellen Stover, Ph.D
Center for Disease Control	Milton Nichaman, M.D.
Food and Drug Administration	Allan Forbes, M.D. (John Vanderveen, Ph.D.)
Health Resources Administration	Louis Steinberg, Ed.D.
National Center for Health Statistics	Robert Murphy
National Institute of Mental Health	Marian Yarrow, Ph.D.
Office of the Assistant Secretary for Health	J. Michael McGinnis, M.D.
Office of Science and Technology Policy, Executive Office of the President	Denis Prager, Ph.D.

ACKNOWLEDGEMENTS

On behalf of the Nutrition Coordinating Committee I wish to thank three members of the NCC Office staff: Ms. Karen Donato for her excellent work in updating the annual report; Dr. Thomas Vogl for the extensive analysis of the program based on the computerized data retrieval system; and Mrs. Sherri Wisner for her technical and editorial assistance in the final preparation of the report.

Artemis P. Simopoulos.

Artemis P. Simopoulos, M.D.
Chairman, Nutrition Coordinating Committee
Office of the Director
National Institutes of Health

PREFACE

The National Institutes of Health is the major agency in the Federal Government that supports research and training in nutrition as it relates to health maintenance, human development throughout the life cycle, disease prevention, and disease treatment. The NIH Program in Biomedical and Behavioral Nutrition Research and Training is supported by all 11 Institutes and one Division, namely:

NCI	-	National Cancer Institute
NEI	-	National Eye Institute
NHLBI	-	National Heart, Lung, and Blood Institute
NIA	-	National Institute on Aging
NIAID	-	National Institute of Allergy and Infectious Diseases
NIAMDD	-	National Institute of Arthritis, Metabolism, and Digestive Diseases
NICHD	-	National Institute of Child Health and Human Development
NIDR	-	National Institute of Dental Research
NIEHS	-	National Institute of Environmental Health Sciences
NIGMS	-	National Institute of General Medical Sciences
NINCDS	-	National Institute of Neurological and Communicative Disorders and Stroke
DRR	-	Division of Research Resources

The NIH nutrition program is coordinated through the NIH Nutrition Coordinating Committee (NCC), which consists of representatives from the 11 Institutes and the Division that support nutrition research, as well as additional NIH offices and liaison members from other agencies within the Public Health Service, from the Office of the Assistant Secretary for Health, and from the Office of Science and Technology Policy in the Executive Office of the President, the White House.

The NIH nutrition program includes extramural and intramural research and research training, and research manpower development. The major component of the NIH nutrition program is the extramural research program carried out at various universities, in graduate science departments principally departments of nutrition, and in medical, dental and other health professional

schools, especially schools of public health. The NIH intramural program in nutrition research is carried out on the NIH campus in Bethesda, Maryland, primarily at the Clinical Center, with the exception of the programs of two Institutes: The intramural program of the National Institute on Aging is carried out at the Gerontology Research Center in Baltimore, Maryland, while that of the National Institute of Environmental Health Sciences is located in Research Triangle Park, North Carolina.

Nutrition is an important, crosscutting program area within the NIH. For this reason, the nutrition program is coordinated through the NIH Nutrition Coordinating Committee that operates out of the Office of the Director and is advisory to the Director. The mandate of the Nutrition Coordinating Committee is to review, stimulate, and encourage the necessary support of nutrition research and training in order to better define the role of nutrition in the promotion of health, and the prevention and treatment of disease. As one of the Committees that oversees selected "trans-NIH health problems," the Nutrition Coordinating Committee meets annually (or as required) with the Director, NIH to review progress and plans in nutrition research.

The Committee is the focus for the review of nutrition research priorities and training, their coordination, and for the development of the NIH Program in Biomedical and Behavioral Nutrition Research and Training. This focus minimizes duplication of effort among the Institutes and identifies areas where research, research training, and research manpower development in nutrition need to be advanced. This is accomplished through joint Program Announcements (PA's) and Requests for Applications (RFA's) developed by the Committee and sponsored by more than one Institute. Committee representatives are also encouraged to have their individual Institutes develop Program Announcements, Requests for Applications, and Requests for Proposals (RFP's).

The Committee plays a key role in the development of nutrition policy at the NIH. Currently, nutrition policy at the NIH emphasizes eight critical areas. Research is emphasized in four of these critical areas: Clinical Nutrition Throughout The Life Cycle; The Role of Nutrition in Disease Development; Prevention of Disease; and Treatment of Disease. The other four critical areas are the Transfer of Modern Nutrition Technology, Nutrition Education for Professionals and The Public, Nutrition Research Training and Research Manpower Development in Nutrition, and the Coordination of all these activities.

Each year, the NCC prepares the Annual Report of the NIH Program in Biomedical and Behavioral Nutrition Research and Training for the preceding fiscal year and sponsors a major conference or workshop in nutrition that includes the interests of many Institutes. The proceedings of this conference are published and made available to interested parties. In addition to coordinating the NIH nutrition program, the NCC Office staff is also assigned additional responsibilities that include responding to requests for information on nutrition from Congress and from other Federal agencies. During FY 1980, the NCC Office continued to serve as the executive secretariat for the Joint Subcommittee on Human Nutrition Research

(JSHNR) that is cochaired by Dr. D. Mark Hegsted, representing USDA, and by Dr. Artemis P. Simopoulos, representing DHHS.

The Chairman of the Nutrition Coordinating Committee has been designated by the Secretary of the Department of Health and Human Services (formerly DHEW) as the "initiative coordinator" for a proposed Health Research Initiative on Nutrition Research. The purpose of the Nutrition Research Initiative is to develop a cohesive program for DHHS in nutrition research and training so that the precise role of nutrition in health and disease can be defined and that appropriate mechanisms emerge for the prevention and proper management of disease. The health research initiatives are experiments in cooperative research planning and implementation by DHHS agencies and represent efforts to strengthen research through cooperative planning and information exchange on a continuing basis.

As in previous years, the Institutes continued to expand the nutrition research program through the publication in the NIH Guide for Grants and Contracts of six Program Announcements, two Requests for Applications and seven Requests for Proposals. A new National Program in Clinical Nutrition Research had its beginning in FY 1979 through the funding of four Clinical Nutrition Research Units (CNRU's). Three additional CNRU's were funded in FY 1980.

FY 1980 also marked the year for the completion of the NCC Office's "computerized" data retrieval system of the NIH nutrition program. This system has allowed for a more extensive analysis of the FY 1980 nutrition program. Thus, this year's report includes a comparison of funded projects in terms of peer review and in terms of the percentage of the "nutrition component" per project. Such analysis indicates that the NIH's Division of Research Grants (DRG) reviewed 71 percent of the number of NIH nutrition grants and contracts active in FY 1980, and the Bureaus, Institutes and Divisions (B/I/D's) reviewed 29 percent. This is consistent with the review of other NIH programs.

The FY 1980 report is the fourth annual report of the NIH nutrition program to be developed by the NCC. The previous three reports included only the nutrition research and training activities for that particular fiscal year. In order to more appropriately close the decade of the seventies, this year's report includes in addition a synopsis of nutrition research activities from FY 1977 through FY 1980 under the heading "Expansion of the Program, FY 1977 - FY 1980."

Part I of the report presents an overview of the NIH Program in Biomedical and Behavioral Nutrition Research and Training from FY 1977 through FY 1980 with special sections that include the Definition of Nutrition Research at the NIH, the NCC Data Retrieval System, a look at the progress and changes in Nutrition Research from FY 1977 through FY 1980, the list of PA's, RFA's, and RFP's related to nutrition research issued since 1977, and a description of the concept of the Clinical Nutrition Research Unit. The financial obligations in nutrition are presented by category of support, followed by an analysis of the peer review of nutrition grants and contracts by DRG and the B/I/D's, and the distribution of the nutrition obligations

and the number of grants and contracts according to the "nutrition component."

Following the analysis are narrative descriptions of the extramural research program, the three Clinical Nutrition Research Units funded in FY 1980, and manpower development. The mechanisms for program development, the intramural research program, and nutrition research training are presented in detail.

The NIH nutrition program is classified according to 15 Special Interest Areas. The expenditures and a synopsis of the kind of research currently funded in each area complete Part I of the report. The Special Interest Areas are: Nutrition and Prevention of Disease, Nutrition and Genetics, Behavioral Studies in Nutrition, International Research in Nutrition, Epidemiological Research in Nutrition, Nutrition and Obesity, Nutritional Status, Nutrition and Aging, Child and Infant Nutrition, Maternal Nutrition, Total Parenteral and Enteral Nutrition, Nutrition Education for the Public, Nutrition Education for Professionals, Nutrition Education Research, and Research on Vitamins.

Part II of the report describes the structure of the NIH Nutrition Coordinating Committee (NCC), the charge of the Program Subcommittee and the charge of the Subcommittee on Nutrition Education, and highlights the Committee's activities and accomplishments in FY 1980.

Part III describes the major responsibilities and activities of the NCC Office. These activities encompass: responding to information requests about nutrition in general and about the NIH nutrition program in particular from the Congress, other Federal agencies, the scientific community and the public; the Science Writers Seminar in Nutrition; the Seminar on the Politics of Nutrition and Public Health; and the Clinical Center Intramural Research Study on the Long Term Effect on Infants of Hypochloremic Metabolic Alkalosis Resulting from Infant Formulas Deficient in Chloride. Other NCC Office activities include participation in international nutrition activities with the Food and Agricultural Organization of the United Nations and the World Health Organization; the activities of the DHHS Nutrition Coordinating Committee and its Subcommittee on Nutrition Research and Research Training; and the Joint Subcommittee on Human Nutrition Research (JSHNR) of the Committee on Health and Medicine (CHM) and the Committee on Food and Renewable Resources (CFRR) of the Federal Coordinating Council for Science, Engineering and Technology (FCCSET), Office of Science and Technology Policy (OSTP) in the Executive Office of the President, the White House.

Part IV consists of eight Appendices: Appendix A includes the Nutrition Policy of the NIH; Appendix B presents the mandate of the Nutrition Coordinating Committee; Appendix C includes a detailed description of the Special Interest Areas of the NIH Nutrition Program; Appendix D describes in detail the FY 1980 International Nutrition Research by Institute; Appendix E consists of the DHHS Nutrition Research Initiative; Appendix F presents the FY 1980 nutrition expenditures of the Institutes and DRR by support mechanism; Appendix G describes the Mission Statements

in Nutrition of the NIH Institutes and the Division of Research Resources; and Appendix H includes the Legislative Authority of NIH for Human Nutrition Research.

As we leave the 1970's, the NIH can look to its program in nutrition research and research training with a sense of satisfaction and accomplishment. The program is strong and has a number of significant new components that have resulted from the combined efforts of the Institutes, the NCC, and the scientific community. The new National Program in Clinical Nutrition Research is based on the concept of the Clinical Nutrition Research Unit (CNRU) developed by the NCC. The seven CNRU's are designed to provide the milieu for research, training and education through an enhanced coordinated effort, and shared resources. We can now look ahead to the 1980's as the decade that will expand further our knowledge on the role of nutrients in health and disease.

Artemis P. Simopoulos

Artemis P. Simopoulos, M.D.
Chairman,
Nutrition Coordinating Committee
Office of the Director
National Institutes of Health

I.

THE PROGRAM IN BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING

The Program in Biomedical and Behavioral Nutrition Research and Training is based on a common definition of nutrition research and a computerized data retrieval system developed by the Nutrition Coordinating Committee. The expansion of the program is the result of a number of Requests for Applications (RFA), Requests for Proposals (RFP) and various Program Announcements (PA) developed by the Institutes themselves or jointly with the Nutrition Coordinating Committee. The program is presented in terms of the financial obligations in nutrition by category of support. The description of the program includes 15 Special Interest Areas that were selected on the basis of scientific classificaiton and political interest.

OVERVIEW OF THE PROGRAM, FY 1977 - FY 1980

In FY 1977, the NCC issued the first "Report of the NIH Program in Biomedical and Behavioral Nutrition Research and Training." Included in that report as one of the NCC's early accomplishments was the definition of nutrition research. The definition serves as a basis for data retrieval and for the assessment of information about the biomedical and behavioral nutrition research and training activities of the NIH.

DEFINITION OF NUTRITION RESEARCH AT THE NIH

The NIH Nutrition Coordinating Committee has defined biomedical and behavioral nutrition research as follows:

> "The term nutrition research includes studies designed to assess the consequences of food or nutrient intake and utilization in the intact organism, including man, and the metabolic and behavioral mechanisms involved. These studies encompass investigation of nutrient variables at the cellular or subcellular level. This definition also includes:
>
> - Research designed to elucidate the metabolic role or function of nutrients in both animal models and man.
> - All studies concerned with genetic-nutrient-environmental interactions where a nutrient is a variable.
> - Dietary studies expected to produce significant changes in health status, including the maintenance of health and the treatment of disease in man. Such studies might include clinical trials, epidemiological studies, metabolic studies, surveillance, and nutritional status monitoring studies."

DATA RETRIEVAL IN NUTRITION

Using the definition of nutrition research as the criterion, the Institutes' program staff reviews all research and training grants and contracts in order to identify those projects with a nutrition component, and then determines the percentage applicable to nutrition. The nutrition obligations are computed from this percentage and the total obligation committed to each project. The NIH has thus been able to eliminate such confusing and easily misunderstood terms as "primary/secondary," "major/minor," nutrition related" and "direct/indirect" in referring to its nutrition program.

The NCC Office has developed a computerized data retrieval system for the storage and analysis of data on all nutrition research grants, program projects, contracts, centers, reimbursement agreements, research training, and manpower development activities of the NIH programs. The data base is updated periodically so that nutrition research and training activities

at the NIH are current. This computer retrieval system has enabled the NCC Office to carry out a detailed analysis of the program in terms of the type of peer review (DRG vs. B/I/D's), and the nutrition obligations and the number of grants and contracts with a nutrition component of 0-20 percent, 21-60 percent, 61-99 percent, and 100 percent nutrition.

EXPANSION OF THE PROGRAM, FY 1977 - FY 1980

Since 1977, NIH has expanded its program in human nutrition research and research training. As indicated in table I, the largest expansion of the nutrition program occurred from FY 1978 to FY 1979 with an increase of approximately $27 million. The FY 1980 NIH total obligation* for nutrition research and training of $139,121,000, is approximately 1-1/2 times the NIH obligation in FY 1977. This expansion is, in part, the result of the publications by the NCC and the individual Institutes of 12 Program Announcements (PA's), 6 Requests for Applications (RFA's), and 16 Requests for Proposals (RFP's) for nutrition research and research training in the 3-year period, June 1977 to September 1980. Table II shows an exponential growth in the number of PA's, RFA's, and RFP's over the 3-year period.

A PA is a formal statement of an NIH extramural research activity or of the initiation of a new or modified mechanism of support. It may describe new or modified program interests, or simply be a reminder of continuing interest.

A RFA is a formal statement which (a) invites grant applications in a well-defined scientific area to accomplish specific program purposes, (b) generally identifies only one application receipt date, and (c) indicates whether or not funds have been set aside for the competition and, if so, the amount of funds and/or the expected number of awards to be made. A RFA may be reissued as necessary. PA's and RFA's lead to the funding of many applications. For instance, 24 grant applications were funded in response to the RFA on "Infant Nutrition" and 10 applications were funded in response to the RFA on "The Effect of Diet on the Metabolism, Structure, Composition, and Blood Levels of High Density and Other Lipoproteins."

A RFP is the government's invitation to prospective offerors to submit a contract proposal based on the terms and conditions set forth in the RFP by the statement of work that describes the nature of intended procurement. The number of contracts awarded as a result of an RFP is smaller. For example, three contracts were awarded in response to the two RFP's on "Nutritional Individuality." The PA's, RFA's and RFP's issued between June 1977 and September 1980 are listed in table III.

---

* Since the dollar figures have been rounded to the nearest thousand, comparisons of the various tables may reveal slight differences in the totals.

Table I

National Institutes of Health
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING,
FY 1977, FY 1978, FY 1979, FY 1980
(in thousands of dollars)

	FY 1977 TOTAL		FY 1978 TOTAL		FY 1979 TOTAL		FY 1980 TOTAL	
	Number	Cost	Number	Cost	Number	Cost	Number	Cost
Extramural								
Research grants	839	$ 38,337	809	$ 44,586	1,100	$ 60,683	1,213	$ 68,472
Program projects	45	8,928	52	7,316	65	9,962	84	16,758
Contracts	122	16,030	137	20,467	200	24,755	200	17,168
Centers	54	9,525	64	9,232	91	12,035	89	11,055
General research support		10,000		13,210		13,427		10,282
Reimbursement agreements	3	460	9	881	11	1,142	16	1,636
Training	182*	2,061	169*	2,419	297*	3,023	335*	3,829
Research career development awards	24*	728	37*	1,129	30*	1,063	37*	1,150
New, young, and academic investigator awards **	6*	179	11*	343	18*	507	44*	989
Extramural Subtotal		$ 86,248		$ 99,583		$126,597		$131,339
Intramural								
Projects	64	6,456	79	6,047	49	6,241	72	7,282
Training	23*	642	31*	668	36*	1,014	20*	500
Intramural Subtotal		$ 7,098		$ 6,715		$ 7,255		$ 7,782
NIH TOTAL NUTRITION RESEARCH AND TRAINING		$ 93,346		$106,298		$133,852		$139,121

* Number of persons.
** In FY 1980 the New, Young, and Special Investigator Awards were combined under the new title, New Investigator Research Awards.

TABLE II

NUMBER OF NUTRITION PA's, RFA's, AND RFP's ISSUED BY NIH
June 1977 to September 1980

	FY 1977	FY 1978	FY 1979	FY 1980	TOTAL
PA	0	2	4	6	12
RFA	1	1	2	2	6
RFP	2	4	3	7	16
Total	3	7	9	15	34

Thus, the expansion of support for extramural nutrition research, research training and research manpower development is, in part, due to the scientific community's enthusiastic response to the nutrition-related PA's, RFA's and RFP's developed by the Institutes and the NCC. This enthusiasm has helped the NIH create a major program on infant feeding, and to expand the programs on obesity, nutrition and cancer, and nutrition and cardiovascular disease, among others.

Table III

PA's, RFA's and RFP's in Nutrition Research and Research Training Published In The NIH Guide For Grants and Contracts, June 1977 to September 1980, Presented In Chronological Order

TYPE	TITLE
RFP	"In Vivo Quantification of Body Nitrogen" (NCI)
RFP	"Quantification of Changes in Body Composition in Cancer Patients" (NCI)
RFA	"Infant Nutrition" (NICHD)
RFP	"Human Milk Bank Research and Distribution Center" (NICHD)
RFA	"The Role of Nutrition in the Rehabilitation of Cancer Patients" (NCI)
RFP	"Validation and Standardization of In Vitro Techniques to Assess the Effect of Diet/Nutrition on the Mutagenic/Carcinogenic Potential of Human Secretions and Excretions" (NCI)
RFP	"Interactions of Diet/Nutrition and the Use of Genetically Distinct Animal Strains in Carcinogenesis Studies" (NCI)
RFP	"Development and Validation of Standard Procedures for the Nutritional Assessment and Monitoring of Adult and Pediatric Cancer Patients and Normal Individuals" (NCI)
PA	"Nutrition in Relation to Health of the Aged and Aging Processes" (NIA)
PA	"Nutritional Aspects of Cancer and its Etiology/Prevention, Treatment, Rehabilitation and Training" (NCI)
RFA	"The Effect of Diet on the Metabolism, Structure, Composition, and Blood Levels of High Density and Other Lipoproteins" (NHLBI)
Joint PA	"Research Grant Support in Nutrition," issued through NIH's U.S./Japan Medical Science Program, and including the following areas for research emphasis: 1) Environmental and host factors affecting nutritional requirements; 2) Iron deficiency; 3) Nutrition and Infection; 4) Effects of nutrition on physical and mental development, behavior, physical capability, and work performance; and 5) Health consequences of different (and changing) dietary patterns and food habits. (NIAMDD, NICHD, NIAID, NCI)
Joint PA	"Studies on Overnutrition and Obesity" (NCC: NHLBI, NIA, NIAID, NIAMDD, NICHD, NINCDS)
RFP	"Prevalence and Impact of Nutritional Individuality" (NICHD)
RFA	"Core Grants for Clinical Nutrition Research Units (CNRU's)" (NCC: NCI, NIA, NIAMDD)

Table III (cont.)

Type	Title
RFP	"Metabolic Basis of Nutritional Individuality" (NICHD)
RFP	"Nutritional Individuality and Dietary Patterns" (NICHD)
Joint PA	"National Research Service Awards for Individual Postdoctoral Fellowships in Nutrition" (NCC: NCI, NEI, NHLBI, NIA, NIAMDD, NIDR, NINCDS)
Joint PA	"National Research Service Awards for Institutional Grants in Nutrition" (NCC: NCI, NEI, NHLBI, NIA, NIAMDD, NIDR, NIEHS, NINCDS)
RFA	"Nutritional Status and Non-respiratory Lung Function" (NHLBI)
PA	"Diet, Nutrition, and Cancer Program Announcement of Research Interests in Alcohol and Cancer" (NCI)
RFP	"Regional Training Workshops for Nutrition Counseling in Hyperlipidemia for Dietitians and Nutritionists" ((NHLBI)
RFP	"Evaluation of Regional Training Workshops for Nutrition Counseling in Hyperlipidemia for Dietitians and Nutritionists" (NHLBI)
RFP	"Examination of the Relationship Between Caries and Tooth Enamel Fluoride" (NIDR)
RFP	"Methodology for Estimation of Human Dietary Sodium Intake or Excretion" (NHLBI)
PA	"Developmental Aspects of Behavior and Nutrition" (NICHD)
PA	"Biobehavioral Approaches to the Treatment of Hypertension" (NHLBI)
RFP	"Longitudinal Studies of Serum Lipoprotein Changes in Users of Various Oral Contraceptive Preparations" (NICHD)
RFP	"Nutrition Coding Center for the Lipid Research Clinics Program and Multiple Risk Factor Intervention Trial" (NHLBI)
PA	"Research on Diseases of the Biliary Tract and Exocrine Pancreas" (NIAMDD)
RFA	"Clinical Trial of Fluoride in Osteoporosis" (NIAMDD)
PA	"Workshop Announcement for Digestive Diseases and Nutrition" (NIAMDD)
RFP	"The Effects of Exposure to Westernization on Infant Feeding Patterns Among Nomadic Populations" (NICHD)
PA	"Research Grant Applications Sought by the National Caries Program" (NIDR)

Clinical Nutrition Research Units

In June 1978, the NIH-NCC sponsored a major conference entitled "The Biomedical and Behavioral Basis of Clinical Nutrition: A Projection for the 1980's."* One of the recommendations that emerged from the conference was on the "need for establishing a new National Program in Clinical Nutrition Research through the support and development of Clinical Nutrition Research Units (CNRUs)."

In response to this recommendation, the NCC developed the concept of the CNRU to form the basis for the establishment of a new National Program in Clinical Nutrition Research. The RFA entitled, "Core Grants for Clinical Nutrition Research Units (CNRU's)," published jointly by NCI, NIAMDD, and NIA in January, 1979, led to funding of four units in FY 1979 and three additional units in FY 1980.

The core grant facilitates the planning and coordination of the CNRU's activities primarily by providing funding for facilities and associated staff that serve the various projects of the unit on a shared basis. This award mechanism promotes interdisciplinary interactions and tends to ensure that a given CNRU has multiple sponsors, both Federal and non-Federal. Thus, any CNRU does not become totally dependent upon any one source of funds for its continuing operations; funding for educational programs and nutritional support services (patient care) is generally from sources other than the NIH.

A CNRU is an integrated array of research, educational and service activities that is oriented toward human nutrition in health and disease. It serves as the focal point for clinical nutrition research activities and for the stimulation of high quality research in areas such as nutritional health maintenance, improved nutritional support of the acutely and chronically ill, nutritional support of the hospitalized patient, assessment of nutritional status, effects of disease states on nutritional needs, and effects of changes in nutritional status on disease. The CNRU is designed to provide the appropriate environment for the education of students, residents, and practicing physicians, as well as trainees and fellows in nutrition. Each CNRU provides support for a new investigator in clinical nutrition. At a minimum, a CNRU must comprise the following seven components: research with human subjects and populations; laboratory investigations; research training; shared facilities and research services; education programs for medical students, house staff, practicing physicians, and paramedical personnel; nutritional support services; and public information activities.

The specific objectives of the CNRU are:

1. To create or strengthen foci in biomedical research institutions for multidisciplinary research in clinical nutrition in order to develop new knowledge about specific nutrients in health, human development, and the prevention and treatment of disease.

* U.S. Department of Health, Education, and Welfare, Public Health Service. NIH Publication No. 80-1970, November 1979, for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 017-040-00460-5.

2. To strengthen training environments in order to improve the education of medical students, house staff, practicing physicians, and paramedical personnel in clinical nutrition.

3. To enhance patient care and promote good health by focusing attention towards clinical nutrition and generating nutritional information for the public.

In order to carry out these objectives, each CNRU is to include: professional personnel consisting of a leader who should be a scientist recognized for his or her expertise in research in clinical nutrition, at least two other associated senior investigators pursuing nutrition research, and other professional personnel as required, e.g. research pharmacists, dieticians, nurses, and technicians; laboratory facilities with clinical research laboratories for special nutrition-related studies (e.g., metabolic, immunologic, endocrine, neuro-endocrine and behavioral research); a research training component to accommodate postdoctoral and new investigator training in clinical nutrition, and to provide opportunities for nutrition research training; educational programs that encourage the integration of nutrition education into other educational activities in relation to health promotion and disease prevention, curriculum development, education of house staff, continuing education of physicians and other health professionals, as well as provide information to the general public; nutritional support services for the assessment, maintenance and improvement of the nutritional status of patients in the hospital and at home; and public information activities to develop the appropriate mechanisms for the application of research knowledge, derived from the CNRU activities, into public education.

The following seven CNRU's were funded in FY 1979 and FY 1980:

° The Clinical Nutrition Research Unit at the University of Chicago is under the direction of Irwin H. Rosenberg, M.D., Professor of Medicine in the Department of Medicine. (Funded by NIAMDD.)

° The Clinical Nutrition Research Unit at the University of Wisconsin is under the direction of Alfred E. Harper, Ph.D., Professor and Chairman of the Department of Nutritional Sciences and Earl Shrago, M.D., Professor of Medicine and Nutritional Sciences. (Funded by NIAMDD.)

° The Clinical Nutrition Research Unit at the University of Alabama in Birmingham is under the direction of Charles Butterworth, M.D., Professor and Chairman of the Department of Nutrition Sciences. (Funded by NCI.)

° The Clinical Nutrition Research Unit at Vanderbilt University's School of Medicine is under the direction of Harry L. Greene, M.D., Associate Professor of Pediatrics and Head, Division of Gastroenterology. (Funded by NIAMDD.)

° The Clinical Nutrition Research Unit at the Medical College of Georgia in Augusta is under the direction of Elaine Feldman, M.D., Chief, Section of Nutrition, Department of Medicine and Director of the Georgia Institute of Human Nutrition. (Funded by NIAMDD.)

- The Clinical Nutrition Research Unit at the Memorial Sloan-Kettering Cancer Center and Rockefeller University is under the direction of Richard S. Rivlin, M.D., Professor of Medicine and Chief of the Nutrition Service at the Memorial Hospital for Cancer and Allied Diseases, and Chief of the Division of Nutrition, Department of Medicine, Cornell University Medical College. (Funded by NCI.)

- The Clinical Nutrition Research Unit at Columbia University's College of Physicians and Surgeons is under the direction of Robert W. Winters, M.D., Professor of Pediatrics. (Funded by NIAMDD.)

FY 1980 PROGRAM IN BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING

The NIH nutrition program is supported by the 11 Institutes and the Division of Research Resources (DRR) and is coordinated through the Nutrition Coordinating Committee (NCC). The program supports research and research training in nutrition as it relates to health maintenance, human development throughout the life cycle, disease prevention, and disease treatment. The mission statements in nutrition of the Institutes and DRR are given in Appendix G.

FINANCIAL OBLIGATIONS IN NUTRITION

The FY 1930 financial obligations in nutrition are presented in table IV. As can be seen from table IV the extramural program is classified by category of support mechanism into Regular Research Grants, Program Projects, Contracts, and Centers. Clinical Trials are funded by all four mechanisms mentioned thus far. General Research Support, Reimbursement Agreements, Training (Training Grants and Fellowships), Research Career Development Awards, and New, Academic and Teacher Investigator Awards are also included in the extramural program. The intramural program consists of Research Projects and Training (fellowships). For FY 1980, NIH obligations for nutrition research and training totalled $139,121,000. The obligations for intramural research and training account for $7,782,000, while those for extramural research, training, and manpower development account for $131,339,000.

Table IV

National Institutes of Health
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1980
(in thousands of dollars)

Item		Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural					
Research grants:	Regular	1,184	$ 64,893		
	Clinical trials	29	3,579		
	Total			1,213	$ 68,472
Program projects:	Regular	78	15,749		
	Clinical trials	6	1,009		
	Total			84	16,758
Contracts:	Regular	135	9,082		
	Clinical trials	65	8,086		
	Total			200	17,168
Centers:	Regular	87	10,988		
	Clinical trials	2	67		
	Total			89	11,055
General research support					10,282
Reimbursement agreements				16	1,636
Training:	Training grants	284*	3,201		
	Fellowships	51*	628		
	Total			335*	3,829
Research Career Development Awards				37*	1,150
New, Academic, and Teacher Investigator Awards				44*	989
Subtotal - Extramural					$131,339
Intramural					
Projects				72	$ 7,282
Training				20*	500
Subtotal - Intramural					$ 7,782
TOTAL NUTRITION RESEARCH AND TRAINING - NIH					$139,121

* Number of persons.

Research Grants and Program Projects are the mechanisms that support the investigator-initiated research of the NIH. In FY 1980, the NIH supported 1,213 research grants in nutrition for a total obligation of $68,472,000. This category constitutes the largest mechanism of support in nutrition. The nutrition obligations for the 84 program projects totalled $16,758,000. Thus, investigator-initiated research in the form of research grants and program projects totalled $85,230,000 or 61 percent of the total FY 1980 nutrition obligation.

Contracts and Centers are the mechanisms that support agency-initiated research. The obligations for the 200 contracts with nutrition research totalled $17,168,000 and obligations for the 89 centers with a nutrition component totalled $11,055,000. The total obligation for agency-initiated research support in nutrition was $28,223,000 or 20.3 percent of the total nutrition obligation in FY 1980.

Clinical trials in nutrition are supported by each of the four major mechanisms discussed above--research grants, program projects, contracts, and centers. A clinical trial is defined as a scientific research activity undertaken to define, prospectively, the effect and value of prophylactic/diagnostic/therapeutic agents, devices, regimens, procedures, etc., applied to human subjects. The study must be prospective, and intervention of some sort must occur. The number of cases or patients depends on the hypothesis being tested, but must be sufficient to permit anticipation of a definite, statistically significant, result. Phase I, feasibility, or pilot studies are excluded by definition.

FY 1980 obligations supporting 102 clinical trials in nutrition totalled $12,741,000. This obligation constitutes 9.2 percent of the total nutrition obligation for FY 1980.

General Research Support is provided almost entirely by the Division of Research Resources (DRR). For FY 1980, a total of $10,282,000 was assigned to this category of the NIH nutrition program. The DRR provides general research support through five mechanisms:

1. The General Clinical Research Centers Program, with obligations of $8,765,299 for nutrition in FY 1980, constitutes the bulk of DRR general research support. These Centers foster the development of technological and therapeutic advances to expedite the application of basic biological knowledge into effective patient care.

The balance of $2,363,480 is provided through the following four mechanisms:

2. The Animal Resources Program provides a unique institutional research environment for the use of nonhuman primates or other animals in multicategorical research.

3. The Biomedical Research Support Program responds to emerging research opportunities and allows the supported institution self-determination in the development and conduct of pilot and other small projects.

4. The Biotechnology Resources Program attempts to interface the knowledge of the physical sciences, mathematics, and engineering with biology and medicine.

5. The Minority Biomedical Support Program provides funds to ethnic minority institutions to conduct research.

Interagency reimbursement agreements are entered into between the NIH and other Federal agencies. In FY 1980, 16 such agreements were made in the area of nutrition, 7 by NCI, 7 by NHLBI, 1 by NIA, and 1 by NICHD.

NCI - "Water Chlorination: Environmental Impact on Health" and "In Vitro Transformation of Epidermal Cells" with the Department of Energy at Oak Ridge National Laboratory; "In Vitro Quantification of Nitrogen by Whole Body Neutron Action" and "Chemoprevention of Epithelial Cancer by Retinoids" with the Department of Energy at Brookhaven National Laboratory in Upton, New York; "Diet and Nutrition, Genetically Distinct Animals, and Carcinogenesis" with the National Center for Toxicological Research; "Research on Occupational Carcinogenesis" with the National Institute of Occupational Safety and Health; and "Epidemiological Studies of Cancer in Alaskan Natives" with the Centers for Disease Control (CDC).

NHLBI - "Clinical Chemistry Standardization Laboratory for the Lipid Research Clinics Program," "Clinical Chemistry Standardization Laboratory for the International Lipid Research Clinics Program," "Clinical Chemistry Standardization Support to the Central Laboratory of the Hypertension Detection and Follow-up Program (HDFP)" (2 percent nutrition), and "Clinical Chemistry Standardization Laboratory to the Multiple Risk Factor Intervention Trial (MRFIT)" with CDC. "Acquisition and Compilation of Data on the Nutrient Composition of Food" and "Nutrient Composition Data for Cardiovascular Disease Research" with the U. S. Department of Agriculture (USDA). An "Agreement for Reimbursable Services for Electrophoretic Testing of Lipoprotein Patterns" is with the Department of Energy.

NIA - "Follow-up Study of U.S. Health and Nutrition Examination Survey (HANES) Respondents with the National Center for Health Statistics (NCHS).

NICHD - "Workshop on Nutritional Requirements of Pregnancy" with USDA.

The total obligation for reimbursement agreements in nutrition was $1,636,000 in FY 1980.

Total obligations in nutrition research and training for each Institute and the DRR are presented in table V. Appendix F (tables F-1 through F-12) presents this information by category of support for each Institute and DRR.

Table V

NIH NUTRITION OBLIGATIONS FOR FY 1980 BY INSTITUTE AND DIVISION
(in thousands of dollars)

NCI	$ 28,687
NEI	4,166
NHLBI	32,184
NIA	4,220
NIAID	1,047
NIAMDD	26,457
NICHD	20,410
NIDR	1,648
NIEHS	3,885
NIGMS	2,451
NINCDS	2,837
DRR	11,129
Total	$139,121

The total NIH obligation for research grants, research training and manpower development, research and development contracts, and intramural research in FY 1980 was $3,096,624,000. The total obligation of the NIH Program in Biomedical and Behavioral Nutrition Research and Training of $139,121,000 is 4.5 percent of the NIH total.

Table VI compares the total NIH extramural obligations in FY 1980 with the nutrition obligations in three categories: research grants and program projects, contracts, and centers. The NIH obligation for these three major components of extramural research totalled $2,331,693,000 with research grants and program projects at $1,593,051,000 or 68 percent of the total. Similarly, the nutrition obligations for the three components totalled $113,453,000, with research grants and program projects at $85,230,000 or 75 percent of the total.

It appears that the total nutrition obligation for the three major components is 4.9 percent of the NIH total. Investigator-initiated research in nutrition is 5.3 percent of the total NIH obligation for this category, while agency-initiated research as contracts and centers with a nutrition component is 3.8 percent of the total NIH obligation of $738,642,000.

Thus, the figures indicate that in terms of the three categories of extramural research support, nutrition research supported in FY 1980 was primarily investigator-initiated and consistent with the overall NIH support of research.

Table VI

COMPARISON OF TOTAL NIH AND NUTRITION OBLIGATIONS IN THE THREE MAJOR COMPONENTS OF EXTRAMURAL RESEARCH
FY 1980 Actual Obligations
(in thousands of dollars)

	NIH Total		Nutrition		Percent of NIH Total
Research grants and program projects	1,593,051	(68%)	85,230	(75%)	5.3
Contracts	406,832	(17%)	17,168	(15%)	4.2
Centers	331,810	(14%)	11,055	(10%)	3.3
TOTAL (of the three components)	2,331,693	(100%)	113,453	(100%)	4.9

EXTRAMURAL PROGRAM: RESEARCH AND MANPOWER DEVELOPMENT

The extramural nutrition program encompasses support for nutrition research carried out at various universities, especially medical, dental and other health professional schools of public health, and nutrition research training or manpower development. An analysis of the overall NIH extramural nutrition program, a description of each Institutes' extramural research and areas of manpower development, and program development of the extramural program are given below.

Analysis

An analysis of all nutrition grants and contracts active in FY 1980 and all "new and competing" nutrition applications in FY 1980 has been carried out in terms of the type of peer review (DRG vs. B/I/D), as well as the nutrition obligations and the number of grants and contracts relative to the percentage of "nutrition component" of each grant or contract.

The initial peer review of all competing nutrition research grant applications is carried out by the Division of Research Grants (DRG), through its Standing Study Sections and Special Study Sections, or by the B/I/D's through Standing Review Committees and Special Committees.

Table VII indicates the total number of extramural nutrition grants and contracts active in FY 1980 as well as the number of new and competing applications reviewed in FY 1980 according to DRG review and B/I/D review. The percent of all "new and competing" nutrition applications reviewed in

FY 1980 by DRG and the B/I/D's was consistent with the review of the overall nutrition program as it stands in FY 1980.

Table VII

PEER REVIEW OF EXTRAMURAL NUTRITION PROGRAM BY INITIAL REVIEW GROUP

	All Active Grants/FY 1980	New and Competing Applications/FY 1980
	Number of Grants and Contracts (Percent of Total)	Number of Grants and Contracts (Percent of Total)
DRG Review	1,255 (71%)	325 (70%)
B/I/D Review	506 (29%)	139 (30%)
Total Reviewed	1,761 (100%)	464 (100%)

Peer review of the nutrition research applications at the NIH has been of interest to many persons in the academic community, the various Government agencies, and the Congress. As a result, the General Accounting Office (GAO) prepared a report, "Nutrition Research Peer Review at the NIH,"* that dealt specifically with a number of questions related to the peer review of nutrition-related research at the NIH.

Since 1977, Congress has been particularly interested in the "nutrition component" of the NIH funded grants and contracts. This interest led the NCC to define "Nutrition Research" as given on page 3, and to develop a computerized data retrieval system that allows for a detailed analysis of the nutrition program in terms of the "nutrition component" of each grant or contract. The nutrition component is the percent of the total obligation of a project identified as nutrition research by the program staff of the Institutes and DRR.

* U.S. General Accounting Office, Washington, D.C. 20548, 6/1/81 (HRD-81-95).

Figure I presents the nutrition obligations of the extramural nutrition program by the percent distribution of the nutrition component of each grant or contract active in FY 1980. The figure shows that 63 percent or $72.9 million of the Institutes' nutrition obligation of $116.4 million is obligated to projects that are 100 percent nutrition.

Similarly, Figure II presents the number of extramural nutrition grants and contracts active in FY 1980 by the percent distribution of the nutrition component. 892 projects or 54 percent of the total 1662 nutrition projects are 100 percent nutrition. Note that Figures I and II do not include the nutrition obligation for training or DRR's FY 1980 obligation of $11,129,000. They do include, however, the obligations for Research Career Development Awards (RCDA), New Investigator Research Awards, and Academic and Teacher Investigator Awards.

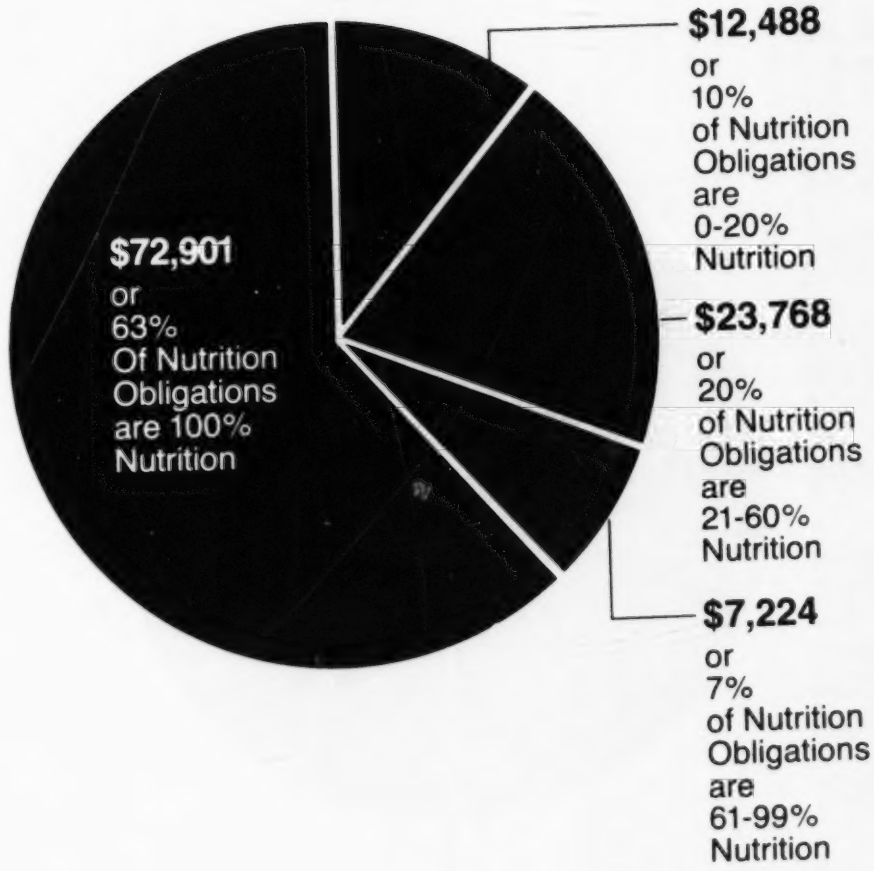
Thus, the FY 1980 nutrition program consists primarily of projects whose principal investigators carry out research that is entirely nutrition research -- 63 percent of the nutrition obligations and 54 percent of the number of extramural nutrition grants and contracts are 100 percent nutrition.

It should be pointed out that the same GAO Report on peer review of nutrition research at the NIH indicated that when members of the scientific community were asked to corroborate NIH's estimates of nutrition-related research expenditures based on the NCC definition of nutrition research, principal investigators for 23 of the 30 selected projects accepted the NIH estimates of project costs for nutrition research. Based on the results of that sample a projection can be made that principal investigators would agree that NIH's estimate for nutrition research expenditures in fiscal year 1979 for the 1,557 projects is from 87.1 to 99.5 percent accurate.

Figure I

Nutrition Obligations of all Grants and Contracts Active in FY'80 by Percent Distribution of Nutrition Component*

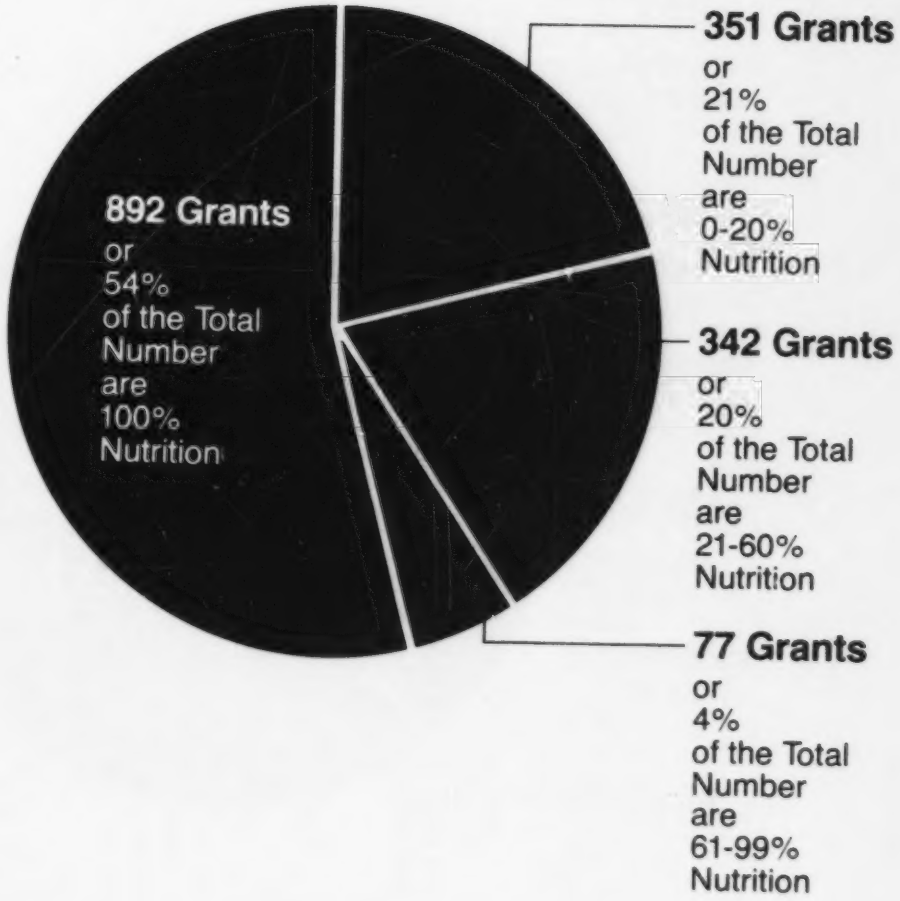
Dollars in Thousands



*Excludes nutrition obligation for DRR and for training.

Figure II

Number of Grants and Contracts Active in FY'80 by Percent Distribution of Nutrition Component*



*Excludes nutrition obligation for DRR and for training.

A similar analysis of the nutrition obligations and the number of all "new and competing" grants and contracts in FY 1980 has been carried out in terms of the nutrition component in order to determine if they are consistent with the entire FY 1980 nutrition program.

As was the case in Figures I and II, Figures III and IV do not include the nutrition obligation for training grants or DRR, new in FY 1980. They do include, however, the obligations for new Research Career Development Awards (RCDA), New Investigator Research Awards, and Academic and Teacher Investigator Awards.

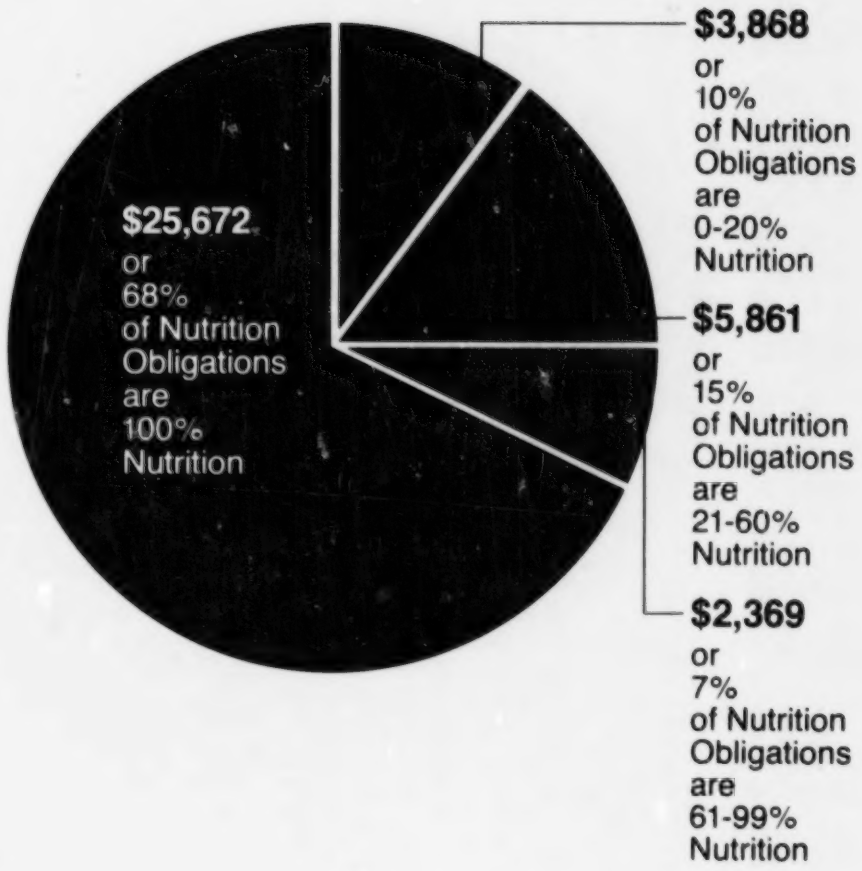
Figure III presents the nutrition obligations of the "new and competing" extramural grants or contracts in the FY 1980 nutrition program by the percent distribution of the nutrition component. The figure shows that 68 percent or $25.7 million is obligated to projects that are 100 percent nutrition. Comparing Figures I and III indicates a 5 percent increase in nutrition obligations for the "new and competing" extramural projects that are 100 percent nutrition.

Figure IV presents the number of "new and competing" extramural nutrition grants and contracts by the percent distribution of the nutrition component. 242 projects or 57 percent of the total 422 new and competing projects in FY 1980 are 100 percent nutrition. Comparing Figure II with Figure IV indicates a 3 percent increase in the number of projects that are 100 percent nutrition.

Figure III

Nutrition Obligations of New and Competing FY'80 Grants and Contracts by Percent Distribution of Nutrition Component*

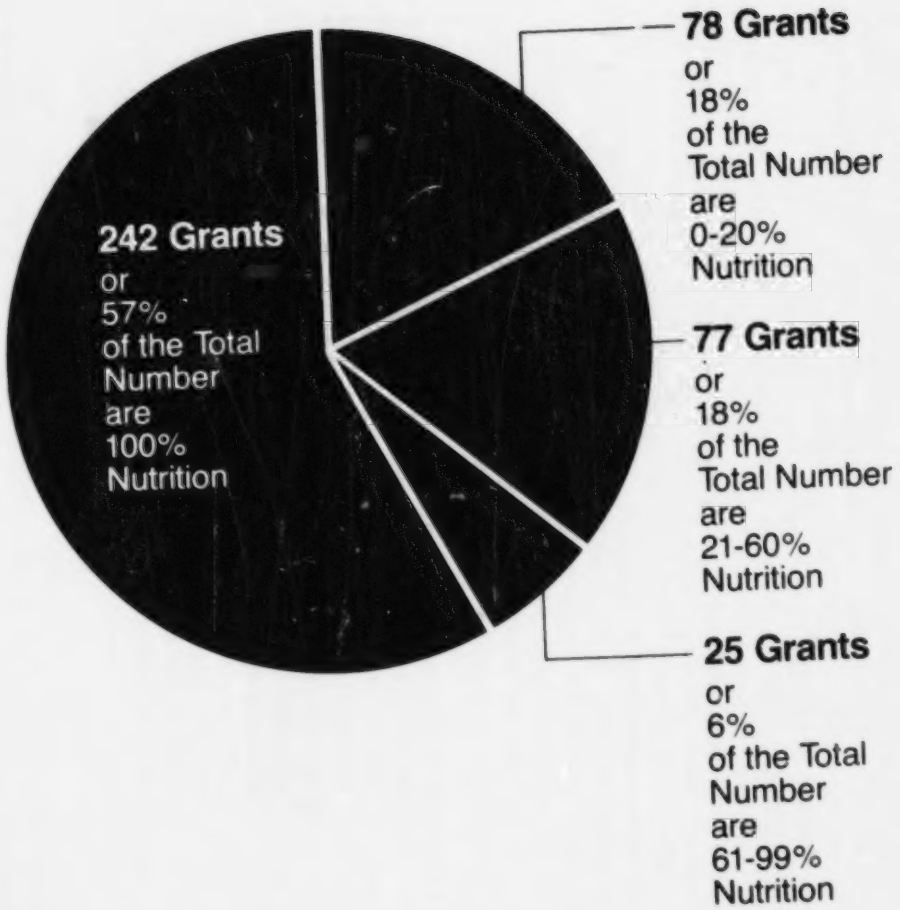
Dollars in Thousands



*Excludes nutrition obligation for DRR and for training.

Figure IV

Number of New and Competing FY'80 Grants and Contracts by Percent Distribution of Nutrition Component*



*Excludes nutrition obligation for DRR and for training.

Description Of The Research Program

Overall nutrition research at the NIH encompasses the effects of nutrients on human growth and development, health maintenance and promotion, disease prevention, and disease treatment. (Appendix H describes the Institutes' legislative authority for human nutrition research.) The primary nutrition mission of the NIH is in biomedical and behavioral research and training, however, nutrition education for the public is an integral part of many programs. Consequently, NIH provides the public with nutrition pamphlets, Public Service Announcements on radio and television, and materials for magazine articles. Nutrition education for professionals is provided through various scientific publications, conferences, and workshops.

The role of nutrition in normal development and disease prevention during all stages of the life cycle, particularly infancy, childhood, adolescence, and old age, is a major portion of the extramural research carried out by NICHD and NIA. The NIAMDD, NIEHS, NIGMS, and DRR also support research on the role of nutrients in health promotion and in human growth and development throughout the life cycle.

In FY 1980, the DRR supported 75 General Clinical Research Centers (GCRC's) in the United States. The research beds, laboratories, professional nursing, and dietary personnel that comprise each center are essential to clinical investigation in nutrition. These centers conduct clinical nutrition studies on obesity, diabetes, cancer, parenteral nutrition, hyperlipidemias, atherosclerosis, vitamins, and environmental health factors. In all, the dietary support personnel working in these centers number 245 full-time equivalent, while 800 interns are trained in these centers per year. Several of the 43 currently funded, clinical associate physicians are directly involved in clinical nutrition research. The team approach in clinical investigation at the centers allows the basic scientist, clinician, dietitian, and nurse to interact in developing systematic methods for nutrition research.

The Diet, Nutrition, and Cancer Program (DNCP) of the NCI supports numerous research projects to elucidate the nature and mechanism of action of known and suspected carcinogens in the food cycle as well as substances with anti-cancer properties such as vitamin A and its synthetic analogs, vitamins E, B_6, B_{12}, C, folic acid, and selenium. The absence or excess of these and other nutrients are being studied for their effect on cellular differentiation, function and transformation. The development of nutritional assessment methods for application to patient populations is an essential part of the overall efforts to improve the nutritional support of cancer patients.

Major investigations are directed toward evaluating the efficacy of nutritional support procedures, particularly TPN, in preventing or treating malnutrition in cancer patients and in developing improved formulations and delivery systems for nutritional support. Research is aimed at determining whether nutritional support before or during cancer therapy can mitigate undesirable side effects, allowing for a more intensive

therapy, and improving the quality of life for the cancer patient. Another major research effort is to develop and apply methods of prevention and treatment to such syndromes as anorexia, cachexia, and malnutrition common in patients with a variety of cancer disorders.

The DNCP also supports, both nationally and abroad, epidemiological studies and surveys on nutrition and the incidence of site specific cancers. Case control studies are also underway to determine if dietary fiber, fat, and vitamins are related to cancers of the colon, breast, stomach, and skin.

The NEI currently supports three clinical trials on the treatment of eye diseases and disorders with vitamins. Protection against induced retinopathies, particularly retrolental fibroplasia, with vitamin E is the subject of two clinical trials. The third clinical trial evaluates treatment of corneal disease with vitamin C. Nutritional deficiencies, particulary vitamin A deficiency, are worldwide causes of eye disease and blindness in children. NEI supports research on the underlying mechanisms that may lead to effective prevention; for example, gyrate atrophy, an inborn error of metabolism, has been identified as a deficiency of ornithine aminotransferase. Research on the role of vitamin A in the development and functioning of the retina and cornea, and the possible role of various nutrients in cataract formation is also underway.

NHLBI investigations in the etiology and prevention of all forms and aspects of heart, blood vessel, lung, and blood diseases, include research into social, environmental, behavioral, nutritional, biological, and genetic determinants and influences. Such studies include epidemiological investigations, clinical trials, animal models, and clinical investigation. In addition, the Office of Prevention, Education, and Control places special emphasis on dissemination of information to professionals and the public regarding diet and nutrition as related to all aspects of the Institute's mission.

The NIA supports research on the effects of specific diseases, therapeutic agents, and medical procedures on the nutritional status of the elderly. Investigations on the effects of aging on nutrient utilization and the relationship to nutrient requirements consider factors regulating changes in lean body mass, energy balance and other metabolic processes, and immune function that occur with aging. Another area of research interest is the relation of nutrition to age-related mental deterioration or senile dementia with subsequent loss of neural function, and to the decline in the sensations of taste and smell, as well as to motor coordination and cognition.

Research interests of NIAID encompass the interactions of nutrition with infections and immunological investigations. These interests focus on the modulating effect of specific nutrients on immune function, mechanisms of food allergies and immune response to ingested antigens, the interaction of nutrition and infection in the tropical environment and in American hospitals, and the modulating effects of specific nutrients on microbial virulence.

The NIAMDD continues to support research on human nutritional requirements, and factors that influence these requirements; the use of new technologies to study the function of nutrients; studies on iron deficiency; research on levels and metabolic roles of trace minerals; basic studies on dietary fiber; research on the interaction of nutrition, immune competence, and infection; obesity research; and studies on the nutritional support of hospitalized patients through Clinical Nutrition Research Units. During FY 1980 the NIAMDD continued to administer the U.S. Malnutrition Panel of the U.S.-Japan Cooperative Medical Science Program and saw the completion of both the ninth revision of the "Recommended Dietary Allowances" and the report on "Research Needs for Establishing Dietary Guidelines for the U.S. Population" prepared under contract by The Food and Nutrition Board, National Research Council, National Academy of Sciences.

The NICHD supports research on the relationship of nutrition to reproduction; maternal nutrition; infant nutrition; adolescent nutrition; nutritional antecedents of adult disease; behavioral and cultural aspects of nutrition; nutritional aspects of developmental gastroenterology; and nutritional status assessment. NICHD research is aimed at understanding how a mother meets the nutritional demands of her growing fetus as well as investigating the biochemistry and genetics of a variety of inborn errors of metabolism, such as galactosemia and phenylketonuria, that are amenable to intervention by dietary means. Other work in the area of infant nutrition focuses on metabolic processes of neonatal adaptation and on the roles played by essential nutrients in optimizing early development, particularly in premature infants or those small for gestational age. Studies on human milk, cow's milk, and synthetic formula consider the optimal nutrient requirements for infant growth and development, emphasize the degree of passive immunity passed to breast-fed infants as compared to bottle-fed infants, and examine the role of specific components of breast milk in stimulating cerebral and gastrointestinal development of the infant. A major effort currently under way is the development of human milk banking technologies for the collection, storage, processing and distribution of human milk and colostrum.

Studies supported by NICHD on the nutritional aspects of developmental gastroenterology emphasize basic research on cellular differentiation in relation to the functional development of the intestine and specific absorption of trace elements and oligopeptides. In the area of nutritional antecedents to adult disease, research focuses on the development of obesity in infancy, childhood, adolescence and early adulthood, and on the nutritional ramifications of diabetes in pregnancy and in infants born to diabetic mothers. The increased demand for nutrients for the adolescent growth spurt and the onset of puberty is also under investigation. In order to determine how cultural attitudes and environment affect individual nutritional habits, anthropological and epidemiological studies are underway to assess differences in eating habits, taste and smell, food aversions, and behavior modification techniques. Research on nutritional status assessment emphasizes the development of noninvasive, economical, precise and convenient methods for assessing nutritional status during infancy, adolescence, pregnancy and lactation.

NIDR supports studies on the relationship between diet and disease, such as dental caries and periodontal disease, as well as on the role of nutrition in the development of hard and soft tissue of the oral-facial complex. The efforts of the National Caries Program have focused on determining the cariogenic potential of various foods, developing noncariogenic sweeteners and special diets to reduce caries, and the use of fluoride as an effective means in preventing caries.

NIEHS studies include interactions between environmental contaminants and nutrients or dietary constituents in biological systems, and the alteration of these systems in order to prevent biological insults through decreased absorption or enchanced excretion. Research on food toxicology examines the uptake, metabolism, and accumulation of natural toxicants in food crops and plants as well as acquired toxicants generated under suboptimal storage conditions. The hazards of food processing, and particularly food additives are studied in order to determine their toxic properties and mechanisms, how they are altered in the food, and how they are transformed by biological systems.

The extramural program of NIGMS is directed toward a better understanding of the biochemical and physiological changes induced by trauma, and the fundamental nutritional aspects of wound healing and biological repair. The Trauma and Burn Program supports research on the nutritional aspects of severe trauma and sepsis, on parenteral protein sparing therapy, on branched chain amino acid feeding during injury, on cellular response in shock, on the nutritional requirements of burn victims, and on the treatment of post-trauma infections.

The NINCDS nutrition activities attempt to clarify the two-way interaction between nutrient intake and the activity of the central nervous system (CNS) with specific projects on behavioral factors and neural control of food intake, the influence of nutrients on the onset or progress of neurological disorders, the metabolic effects of nutrients on hereditary metabolic disorders that cause neurological abnormalities, the transport of nutrients and their metabolic products across the blood-brain and blood-cerebrospinal fluid barriers, and the peripheral effects of drugs used in CNS disorders on the intake and utilization of nutrients.

In summary, the Institutes with mandates in categorical diseases support nutrition research programs in their areas of responsibility in both the prevention and the treatment of disease: namely the NCI on diet and cancer; NIDR on nutrition and dental caries; NHLBI on diet and heart, lung and blood disorders; and NEI on nutrition and various eye disorders, etc. The NIA, NIAMDD, and NICHD support nutrition research particularly related to nutrient requirements relevant to the different stages of the life cycle and specific metabolic and genetic diseases. Through sophisticated studies in biochemistry, physiology, and cell biology, NIH-supported research aims at elucidating fundamental mechanisms and at synthesizing the results into practical information on nutrition and diet that will assist the individual to develop normally, and to live as long and as healthy a life as possible.

Clinical Nutrition Research Units:

As stated previously in this report, FY 1979 marked the year of a new National Program in Clinical Nutrition through the development by the NCC of the joint RFA "Core Grants For Clinical Nutrition Research Units (CNRU)," and the funding of four CNRU's. In FY 1980, three additional CNRU's were funded and are described below:

The CNRU at the Medical College of Georgia in Augusta, is under the direction of Elaine Feldman, M.D., Chief, Section of Nutrition, Department of Medicine and Director of the Georgia Institute of Human Nutrition. The CNRU provides partial support and the structure for the administrative and laboratory activities of the Georgia Institute of Human Nutrition (GIHN). A nutritional biochemist investigator supervises three core laboratories: lipids, trace metals, and nutritional biochemistry. The staff of the CNRU functions in one or more of the three nutrition-related areas of clinical research, education and training, and service. The nutrition education program in the School of Medicine is supported in conjunction with a separately funded curriculum development grant in applied nutrition. The goal of the CNRU is to search for solutions of the etiology and treatment of nutrition-related disorders affecting the population of Georgia. The joint efforts of the School of Medicine, the GIHN, the CNRU, and the interdisciplinary team curriculum in nutrition provide a resource to enhance the effective role of nutrition as an important discipline in patient care. (Funded by NIAMDD.)

The CNRU under the direction of Richard S. Rivlin, M.D., Professor of Medicine and Chief of the Nutrition Service at the Memorial Hospital for Cancer and Allied Diseases, and Chief of the Division of Nutrition, Department of Medicine, Cornell University Medical College, is the major focus for the nutrition activities of the Memorial Sloan-Kettering Cancer Center and Rockefeller University. A collaborative program with the participating institutions includes developing the following seven components of the CNRU: research with human subjects and populations; laboratory investigations; research training; shared research facilities and services; education programs for medical students, physicians, and paramedical personnel; nutritional support services; and public information activities. This CNRU establishes an administrative core facility that includes the following five core laboratories: immunology, lipids metabolism, metals, mass spectrometry, and biophysics. (Funded by NCI.)

At Columbia University's College of Physicians and Surgeons, the Clinical Nutrition Research Unit is directed by Robert W. Winters, M.D., Professor of Pediatrics. The CNRU includes the following three core components: clinical, laboratory, and computer-biostatistics cores. Activities of this CNRU focus on the pediatric patient since large research, education, and training programs already exist in the Department of Pediatrics and the Institute of Human Nutrition at Columbia. Pediatrics offers important and unique opportunities for the study of nutritional problems in patients. Plans include building onto existing programs in parenteral and enteral nutrition, and clinical and basic nutrition research. This research is directed towards providing adequate nourishment to the fetus, the pre-

mature or term infant, and the child and adolescent. The new projects planned with a nutrition component embrace such diverse fields as cardiology, oncology, allergy, pulmonary disease, immunology, neonatology, and perinatology. In addition to catalyzing new areas of nutrition research, the CNRU acts as a major new institutional resource for the integration of research, education, and service in the field of clinical nutrition. (Funded by NIAMDD.)

Many unanswered questions remain on the relationship of diet to health and disease, especially cancer, other chronic diseases, and aging. To answer these questions nutritional science must integrate many disciplines such as biochemistry, molecular biology, genetics, and physiology, as well as medical specialties such as internal medicine, pediatrics, and surgery. A close interaction among research, health services, and education is crucial for the advancement of nutritional science. The seven Clinical Nutrition Research Units are designed to provide the milieu for research, training, and education through enhanced coordinated effort, intellectual stimulation, and use of shared resources.

Description Of Manpower Development

Manpower development in nutrition research is enhanced through Research Career Development Awards and through Special Research Awards. The total obligation for these award programs was $2,139,000 for FY 1980.

Research Career Development Awards (RCDA's) are awarded to enhance the career development of outstanding scientists with clear research potential or demonstrated capacity for independent research who require additional training and experience in a productive scientific environment to prepare for careers in independent research. In FY 1980, 37 RCDA's were awarded in nutrition by NCI, NEI, NHLBI, NIA, NIAMDD, NICHD, NIDR and NIGMS for a total obligation of $1,150,000.

Several areas of research were under study by RCDA recipients. In nutrition and cancer, these included: the biosynthesis of mammalian glycoproteins, lipids and membrane structures of leukemia leukocytes, thymidine transport in normal and leukemia lymphocytes, asparagine biosynthesis in normal and tumor cells, hexosaminidase levels and diet, and diet and etiology of breast cancer. In the area of cardiovascular diseases, research included: water metabolism in heart failure, sodium intake and the effects of potassium on hypertension, and the regulation of cholesterol metabolism in cultured cells.

Metabolic studies included research on: new dietary treatments in diabetes and various types of obesity, genetic and acquired obesity, metabolic and endocrine aspects of obesity, metabolic effects of diet and meal pattern, regulation of food intake and body fat, regulation of human gastric responses to meals and hypothalamic control of body weight and feeding, exercise and lipid metabolism, enzymatic control of vitamin D_3 endocrine complex, metabolic effects of burn injury and sepsis, protein nutrition in experimental uremia, glycerol-3-phosphate dehydrogenase and egg yolk avidin, and nutrition and drug metabolism in man. Studies on human development

included research on: evaluation of dietary alterations and treatments, development and control of hepatic and renal gluconeogenesis, biochemical basis for experimental Fanconi Syndrome, nutrition and development of adipose tissue, maturation of neonatal carbohydrate homeostasis, chemical studies in growth and development, and maturational and adaptive changes in intestinal carbohydrate absorption in the postnatal period by noninvasive techniques of breath analysis. Other research covered nutrition and the oral mucous membranes, the biochemistry of oral tissues, and visual pigment and photoreceptor adaptation.

Special Research Awards (New Investigator Research Awards, Academic Investigator Awards and Teacher Investigator Awards) are used also by the NIH as additional mechanisms for manpower development in nutrition.

In the past, Special Research Award programs included the "New, Young, and Special Investigator Awards" that were issued to support basic and clinical studies so that newly trained investigators could remain active during the developmental stage of their careers. In FY 1980, the elements of all "New, Young, and Special Investigator Awards" were combined under the single title of "New Investigator Research Award (NIRA)." The purpose of the NIRA is to encourage new investigators (including those who have interrupted early promising research careers) in basic or clinical science disciplines to develop their research activities within the program interests at NIH. This special grant-supported program provides research grant funds to help bridge the transition from training status to that of established investigator. The NCC plans to develop a joint program announcement for a NIRA in nutrition for FY 1981.

"Academic Investigator Awards" create and encourage a stimulating approach to disease curricula that will attract high-quality students, foster academic career development of promising young teacher-investigators, develop and implement excellent multidisciplinary curricula through an interchange of ideas, and enable the grantee institution to strengthen its existing teaching program.

"Teacher Investigator Awards" provide the opportunity for promising medical scientists (with demonstrated aptitude to develop into independent investigators) or faculty members who will pursue research aspects of categorical areas applicable to the awarding unit, and aid in filling the important academic faculty gap in these shortage areas within health professional institutions of the country. The "Academic and Teacher Investigator Awards" are not used by all of the B/I/D's.

In FY 1980, 44 awards were made in these three categories for research manpower development in nutrition: 25 New Investigator Research Awards for a total obligation of $734,000; 18 Academic Investigator Awards totalling $200,000; and 1 Teacher Investigator Award of $55,000. The total obligation for these programs was $989,000.

The areas under study by the 44 recipients of these awards include: fat metabolism and obesity, trace metals, hypertension and cardiovascular diseases, cancer, trauma, immune function, and eye disorders. The specific studies in each of these areas are as follows:

- fat metabolism and obesity - polyunsaturated fatty acid metabolism in human cells, membrane integrity and cyclopropenoid fatty acids, sympathoadrenal regulation in experimental obesity, regulation of fat and protein synthesis, lipid esterification in liver and mammary gland, regulation of enzymes of triaglycerol metabolism, and phospholipid in plasma lipoproteins

- trace metals - the biochemical role of zinc in teeth and bones, the influence of dietary magnesium, influence of trace metals on dental health, and neonatal gastrointestinal absorption of lead

- hypertension and cardiovasular disease - neural control of renal tubular sodium reabsorption, coronary risk and psychology of dietary adherence, behavioral aspects of salt intake and hypertension, and common residence, network dynamics and blood pressure

- cancer - dietary fats and antioxidants in mammary carcinogenesis, and preventive oncology

- trauma - branched chain amino acid infusion in trauma

- immune function - effects of retinoic acid on the immune system, and functional properties of immunocytes in human breast milk

- eye disorders - pathological studies of ocular surface disorders, and photoreceptor transductions and retinal synapse formation.

Program Development

A major responsibility of the NCC is to identify areas for further research and bring them to the attention of the scientific community through the development and publication of Program Announcements (PA's), Requests for Applications (RFA's), and Requests for Proposals (RFP's).

Table VII lists the 15 PA's, RFA's, and RFP's in nutrition published in FY 1980, with the origin and date of each announcement, the type of announcement, and its title. A brief description of each announcement follows the table. Included in the table are 6 PA's, 2 RFA's, and 7 RFP's. It is of interest that all new activities in FY 1980 involved individual Institutes. Note that neither joint nor NCC sponsored announcements were developed, and that out of the 15 announcements only 2 RFA's were developed.

TABLE VII

PA's, RFA's AND RFP's In Nutrition Research And Research Training Published In The NIH Guide For Grants and Contracts in FY 1980

ISSUED BY	DATE	TYPE	TITLE
NHLBI	12/1/79	RFA	"Nutritional Status and Nonrespiratory Lung Functions"
NCI	1/3/80	PA	"Diet, Nutrition, and Cancer Program Announcement of Research Interests in Alcohol and Cancer"
NHLBI	1/7/80	RFP	"Regional Training Workshops for Nutrition Counseling in Hyperlipidemia for Dietitians and Nutritionists"
NHLBI	1/7/80	RFP	"Evaluation of Regional Training Workshops for Nutrition Counseling in Hyperlipidemia for Dietitians and Nutritionists"
NIDR	1/15/80	RFP	"Examination of the Relationship Between Caries and Tooth Enamel Flouride"
NHLBI	1/19/80	RFP	"Methodology for Estimation of Human Dietary Sodium Intake or Excretion"
NICHD	1/25/80	PA	"Developmental Aspects of Behavior and Nutrition"
NHLBI	1/25/80	PA	"Biobehavioral Approaches to the Treatment of Hypertension"
NICHD	2/22/80	RFP	"Longitudinal Studies of Serum Lipoprotein Changes in Users of Various Oral Contraceptive Preparations"
NHLBI	5/13/80	RFP	"Nutrition Coding Center for the Lipid Research Clinics Program and Multiple Risk Factor Intervention Trial"
NIAMDD	5/16/80	PA	"Research on Diseases of the Biliary Tract and Exocrine Pancreas"
NIAMDD	6/6/80	RFA	"Clinical Trial of Fluoride in Osteoporosis"

TABLE VII (continued)

ISSUED BY	DATE	TYPE	TITLE
NIAMDD	6/6/80	PA	"Workshop Announcement for Digestive Diseases and Nutrition"
NICHD	6/6/80	RFP	"The Effects of Exposure to Westernization on Infant Feeding Patterns Among Nomadic Populations"
NIDR	8/29/80	PA	"Research Grant Applications Sought By the National Caries Program"

Description of Announcements:

The RFA, "Nutritional Status and Nonrespiratory Lung Functions," issued by NHLBI, requested studies to elucidate the mechanisms by which nonrespiratory function of normal mature lungs are influenced by nutritional status. Areas of research supported under the announcement are nonrespiratory lung functions such as protein synthesis and degradation, (including collagen and elastin), lipid metabolism, DNA and RNA content, alterations in enzymes participating in lung defense, and energy metabolism.

The PA, "Diet, Nutrition and Cancer Program Announcement of Research Interests in Alcohol and Cancer," issued by NCI, encouraged grant applications in the areas of epidemiological studies in alcohol-related cancer and basic research on alcohol effects on tumor development. Epidemiological studies combined with experimental work, are needed to delineate the steps by which alcohol consumption leads to liver cancer and to resolve the suggestion that certain beverages may predispose persons to cancer of the pancreas and rectum. Areas of basic research include: effects of alcohol on the natural history and pathogenesis of experimentally induced tumors in animals, including the effects of alcohol on immune response; influence of alcohol on the malignant potential of chemicals, oncogenic viruses and radiation; and the effects of alcohol on carcinogenesis in vivo and in vitro.

The RFP, "Regional Training Workshops for Nutrition Counseling in Hyperlipidemia for Dietitians and Nutritionists," issued by NHLBI, solicited proposals to undertake regional training workshops for nutrition counselors to increase their knowledge and skills in three general areas: patient interviewing and nutrition counseling; assessment of characteristics related to patients and to nutrition counselors that influence nutrition education efforts; and diets in relation to hyperlipidemia, including modification for related dietary problems of obesity, diabetes, and sodium restriction. This workshop program is to test the suitability of a model workshop in various regions under the direction of personnel skilled in nutrition as related to cardiovascular disease in selected institutions or organizations.

The RFP, "Evaluation of Regional Training Workshops for Nutrition Counseling in Hyperlipidemia for Dietitians and Nutritionists," issued by NHLBI as part of the Institute's Evaluation Program, solicited proposals for the evaluation of this program of regional workshops for nutrition counseling to determine the effectiveness, feasibility, and desirability of conducting such workshops on a regional basis. The effects of the workshop programs on the knowledge and practice of the nutrition counselors will be evaluated in order to make recommendations for improvement, and to stimulate other organizations to undertake similar activities.

The RFP, "Examination of the Relationship Between Caries and Tooth Enamel Fluoride," issued by NIDR, solicited proposals to establish and/or refine an acid etch biopsy procedure in vitro, suitable for studies in vivo, in order to examine whether a relationship exists between the subsurface fluoride content of the enamel and individual caries experience. Establishment of such a correlation would facilitate the identification of high risk individuals for participation in clinical trials and could be used to predict caries protection on smooth surfaces from new topical and/or systemic fluoride regimens.

The RFP, "Methodology for Estimation of Human Dietary Sodium Intake or Excretion," issued by NHLBI, solicited proposals for the development of improved, convenient, valid, and relatively inexpensive innovative quantitative methodology for the estimation of human dietary sodium intake or excretion. Methods to determine the sodium intake of an individual and a subgroup of individuals in a homogeneous population are useful in metabolic studies to investigate a causal relationship between sodium intake and blood pressure, and in epidemiological or preventive studies to examine the role of sodium in the etiology and treatment of high blood pressure.

The PA, "Developmental Aspects of Behavior and Nutrition," issued by NICHD, solicited grant applications for studies on the determinants of food selection and aversion, and of food intake at critical stages of the life cycle, during pregnancy, infancy, childhood, and adolesence. Studies may range from investigations of neurochemical determinants of ingestive behavior to analysis of historical, geographical, evolutionary, cultural, and psychological factors that influence ingestive behavior. Behavioral aspects of nutrition also should be amenable to study by using the methodologies of disciplines such as psychology, sociology, history and anthropology.

The PA, "Biobehavioral Approaches to the Treatment of Hypertension," issued by NHLBI, solicited grant applications for research projects to evaluate combinations of pharmacologic and non-pharmacologic therapies in the treatment of patients with diagnosed essential hypertension. Pharmacologic antihypertensive therapy has been particularly effective in reducing blood pressure in severely and moderately hypertensive patients while non-pharmacologic approaches such as exercise, diet, relaxation techniques, biofeedback, meditation, and psychotherapy have been less effective but demonstrate potential utility in maintaining pharmacologically lowered pressure. The issue of whether combinations of pharmacologic and non-pharmacologic therapies produce a synergistic effect need to be explored.

The RFP, "Longitudinal Studies of Serum Lipoprotein Changes in Users of Various Oral Contraceptive Preparations," issued by NICHD, solicited proposals to compare various commercial oral contraceptive preparations in relation to their effect on serum lipoprotein patterns, glucose tolerance, and insulin response. These parameters will be considered in a longitudinal study of women before they begin oral contraception, and during a 12 to 18 month period after they begin oral contraception.

The RFP, "Nutrition Coding Center for Lipid Research Clinics Program and Multiple Risk Factor Intervention Trial," issued by NHLBI, solicited proposals for a nutrition coding center for the ongoing NHLBI Lipid Research Clinic (LRC) and Multiple Risk Factor Intervention Trial (MRFIT). The RFP defined the following functions of a nutrition coding center: to provide coding of the dietary recalls collected by the LRC & MRFIT programs; to maintain the nutrient data base and components of the coding system; and to provide regular training sessions and continuing education programs in dietary data collection for the LRC and MRFIT nutritionists to encourage their participation in the computerized analysis of the dietary data.

The PA, "Research on Diseases of the Biliary Tract and Exocrine Pancreas," issued by NIAMDD, solicited applications to support research and related training into the causes, diagnosis, prevention, and treatment of the diseases of the biliary tract and the exocrine pancreas. The areas of research include: multidisciplinary studies on pigment gallstone disease; studies on the effect of diet and/or drugs on biliary cholesterol saturation and plasma lipids in man and other primates; studies to discover oral and nontoxic agents that induce cholesterol unsaturated bile; and epidemiological studies to identify those individuals at greater risk for pancreatic disease, and to determine possible factors (diet, alcohol, exposure to environmental pollutants, and regional factors) that predispose certain individuals or groups of individuals to the development of pancreatitis.

The RFA, "Clinical Trial of Fluoride in Osteoporosis," issued by NIAMDD, requested applications for a clinical trial to assess the efficacy of fluoride as a therapeutic agent in treating patients with osteoporosis. Clinical data are needed to ascertain the effectiveness or toxicity of sodium fluoride at the higher dosage levels since fluoride is generally thought to stimulate osteoblastic activity and thereby increase trabecular bone mass. The primary evaluative criterion will be the incidence of fractures.

The PA, "Workshop Announcement for Digestive Diseases and Nutrition," issued by NIAMDD, requested Letters of Intent from individuals planning to submit applications for workshops or conferences to be held between October, 1981 and the end of September, 1982. An ultimate objective of the meeting is to stimulate new approaches to a problem and to encourage new investigators to become involved with a problem.

The RFP, "The Effects of Exposure to Westernization on Infant Feeding Patterns Among Nomadic Populations," issued by NICHD, solicited studies to collect information on sociodemographic and attitudinal factors, medical conditions as well as indicators of westernization, all of which may influence

the decision to breast or bottle feed in Nomadic populations. The specific research objectives are to describe the trend in breast and bottle feeding in a nomadic group, that is partially undergoing a transition to a sedentary lifestyle, and to describe characteristics or possible indicators of exposure to westernization distinguishing breast from bottle feeders in both groups.

The PA, "Research Grant Applications Sought by the National Caries Program" issued by NIDR, solicited grant applications to study the etiology, pathogenesis, and prevention of dental caries in order to develop practical methods to reduce the incidence of coronal and root caries, and ultimately eliminate these major health problems. Since dental caries result from demineralization of the susceptible tooth surface by acid produced by oral flora from dietary carbohydrates, the interests of the National Caries Program focus on four strategy areas: 1) combat the responsible microbial agents, 2) increase the resistance of the tooth and host, 3) decrease caries conducive properties of the diet, and 4) improve delivery and acceptance of caries preventive measures. Two examples of areas of needed research are determining the cariostatic mechanisms of fluoride action and the influence of other dietary trace elements both on the tooth and on the cariogenic oral flora, and evaluating the impact of non-carbohydrates and of carbohydrates other than sucrose on the cariogenicity of the diet.

INTRAMURAL RESEARCH PROGRAM

As shown in table IV on page 14, obligations for intramural research in nutrition for FY 1980 totalled $7,782,000.

The NIH intramural program in biomedical and behavioral nutrition research is carried out by NCI, NEI, NHLBI, NIA, NIAMDD, NICHD, NIDR, and NIEHS. Most of this research program is conducted on the NIH campus in Bethesda. However, NIA's intramural program is located at the Gerontology Research Center in Baltimore, and the staff of the NIEHS conducts research in Research Triangle Park, North Carolina.

The research projects include prospective randomized clinical studies, longitudinal studies on the metabolism of nutrients and on food toxicity in normal volunteers and patients with various disease states, and animal studies.

Some of the ongoing long-term studies that continued during FY 1980 are: The U.S. Cancer Mortality Survey, where the role of nutrients in cancer mortality is an important component; studies on the effects of total parenteral nutrition in the treatment of cancer; and longitudinal studies on human aging.

A substantial portion of research conducted intramurally focuses on the effects of nutrition on mental, physical, and psychological development. Obesity in childhood is being investigated to provide information on

changed hormone levels or other changes that appear in obese children as opposed to normal weight children. Calcium balance studies in infants and children with unusual bone disorders now can make use of a new technique that employs non-radioactive substances, including calcium, as tracers. Iron, chromium, and zinc metabolism is also under investigation since the presence or absence of a particular trace metal may dramatically change the uptake, need, or serum and tissue levels of another trace metal.

In other studies, methods of dietary management of glycogen storage disease, the inborn error of metabolism characterized by the inability of the liver to produce glucose, are being evaluated, as is the antioxidant potential of vitamin E within the cells of individuals with glutathione synthetase deficiency.

A large group of studies focuses on nutritional factors that relate to the etiology, morbidity, and mortality of metabolic and other diseases that occur throughout the life cycle. Of special significance are studies on: 1) the effects of obesity and eating patterns on insulin receptors and diabetes, 2) intestinal and hormonal factors that affect the regulation of digestion and the bioavailability and absorption of nutrients, 3) the role of obesity and diabetes on gall bladder disease, with special studies in American Indians, and 4) nutrition and cystic fibrosis.

Studies on the effects of nutrition on the aged and the aging process continue to receive considerable attention in the NIA intramural program. The Longitudinal Study on Human Aging conducted at the Gerontology Research Center in Baltimore is an intensive multidisciplinary study that includes evaluation of nutritional factors. These studies are aimed at assessing the role of controllable variables in the life history of the participants. More than 1,000 men have been studied, ranging in age from the early 20's into the 90's. Their return at 1- to 2-year intervals for 2-1/2 day examinations generate data that will permit an assessment of the role of nutrition in the development and prevention of age-associated diseases and in the rate of change with time in physical, physiological, biological, and intellectual function. In this longitudinal study, dietary information is being obtained using a 1-week diary technique. Computer technology permits the conversion of this type of information into detailed nutritional data on intake of calories, protein, fat, and carbohydrate; type of fatty acid and carbohydrate ingested; and vitamin and mineral consumption. Furthermore, since the same individuals are repeatedly studied, the effect of aging on dietary habits and the impact of psychosocial influences on nutritional preferences can be tracked.

In addition to these clinical studies, animal studies are underway on the relationship between nutrition and longevity. Results from studies relating the biochemical characteristics of animal tissues to several dietary regimens known to increase lifespan have supported a working hypothesis that an increased lifespan associated with reduced intake of dietary protein may be related to the rate of genetic transfer. Other biochemical studies attempt to determine the nutritional, biochemical, and physiological roles of a variety of essential nutrients (vitamins A and E and trace minerals) with special emphasis on nutrient needs for optimal functioning of liver

and small intestine; to define the metabolic function of certain nutrients such as folic acid in enzyme reactions; to study the effects in laboratory animals of nutrient intake and nutrient deficiencies on tissue levels of various metabolites, as well as on naturally occurring carinogens; and to isolate and identify goitrogens naturally occurring in water sources for antithyroid activity. Other metabolic research encompasses the role of gastrointestinal hormones, other intestinal factors, and pancreatic secretion in digestion; the role of lingual lipase in digestion of fats; nutritional problems in cystic fibrosis; mineral metabolism; and the effect of obesity on cellular metabolism.

The intramural program also includes environmental studies, specific research on cancer, coronary artery disease, dental caries and periodontal disease, and studies on the effects of nutrition on functions of the eye. This research is described below.

The possible interactive relationship between nutrients and environmental contaminants is being researched in both animal and human studies. The human studies focus on the health effects of possible exposure to low-dose environmental pollutants that can result in the polychlorinated biphenyl (PCB) contamination of breast milk. The animal studies include examination of the utility of pica as a behavioral assay of toxicosis, and investigations on the interaction between diet and food restriction on the neurobehavioral toxicity of acrylamide. Studies evaluate the effects of starvation, vitamin A deficiency, and excess food on the intestinal enzymes responsible for activation or inactivation of foreign chemicals.

Other experiments are concerned with understanding the development of physiologic functions of the normal small intestine and the effects of environmental pollutants on these basic functions. Placental transfer rates of chemicals as well as their presence in milk have been of particular interest in perinatal toxicology and pharmacology studies.

A substantial number of projects in the intramural nutrition program are concerned with cancer etiology, treatment, chemo-prevention, and information dissemination. Intramural research is being carried out within the Division of Cancer Cause and Prevention (DCCP), the Division of Cancer Biology and Diagnosis (DCBD), and the Division of Cancer Treatment (DCT). A series of research efforts by the Environmental Epidemiology Branch of DCCP is seeking to determine the underlying causes and etiologic agents that determine an individual's susceptibility to cancer. This research includes several cross-cultural surveys and case control studies of migrant populations such as the Japanese, Norwegian, Colombian and Polish, and studies of selected high-risk populations within the United States and Canada. Of particular interest in these studies is the consumption of coffee, saturated fats, drinking water, and non-nutritive sweeteners such as saccharin. The carcinogenicity of foodstuff contaminants and artificial sweeteners is also being studied in primates, while the effects of specific fatty acids and lipotropes in modifying the uptake and resistance to carcinogens is being studied in mammary and hair cells. Several carcinogenesis projects are also under way to investigate the potential of natural and

synthetic retinoids to alter or reverse preneoplastic changes in epithelial tissue in specific organ sites such as skin, bladder, tracheobronchus, and lung *in vitro* and *in vivo*. Other studies are investigating the role of specific nutrients in carcinogenesis *in vivo* and *in vitro*.

Several multidisciplinary nutrition and cancer therapy studies are underway by the Surgery Branch of the DCT to investigate the role of total parenteral nutrition in the treatment of esophageal cancer and diffuse histiocytic lymphoma in adults, and of metastatic sarcomas in adolescents. The first prospective randomized protocol on the use of total parenteral nutrition (TPN) as an adjunct to aggressive chemotherapy and radiation therapy has been initiated. Patients receiving TPN are studied for deficiencies of vitamins, trace metals (zinc, copper, chromium), essential fatty acids, and for efficacy of TPN. Studies are performed on gluconeogenesis, protein synthesis, alanine kinetics, glucose disposal, potassium levels, and mineral balance. One study of chemotherapy and oral antibiotics on gastrointestinal function is underway in lymphocytic leukemia patients in the hope of identifying the biochemical basis for the nutritional depletion and general deterioration of the cancer patient. Studies in animal models and tissue culture are also being used to investigate the questions of nutritional support, efficacy, and tolerance as they apply to the clinical situation. Attempts are being made to identify the cause of nutritional depletion and general deterioration of the host (cancer cachexia) with the hope of blocking or reversing such systemic effects so that a person can become more responsive to anticancer therapies.

The NHLBI has a program of general laboratory and clinical research underway in heart, blood vessel and lung diseases, and in certain blood diseases. The program also develops technology related to cardiovascular and pulmonary diseases. A major research activity is concerned with the biosynthesis, transport, and catabolism of plasma apolipoproteins and lipoproteins while another important area is directed toward the effect of dietary lipids on atherogenesis. The type II Coronary Intervention Trial is testing the hypothesis that if blood lipids are lowered, cardiovascular morbidity and mortality will be reduced.

In order to determine the relationship of diet and nutrition to dental caries, periodontal disease, and the growth, development, and well-being of both hard and soft tissues of the oral-facial complex, the National Caries Program is conducting research to identify and develop noncariogenic sweeteners for use as sugar substitutes in snack foods; to assess the effectiveness of dietary and waterborne fluoride, strontium, selenium, lithium, and other trace elements on preventing dental caries; and to identify and characterize food items with low cariogenic potential through a screening program.

The NEI carries out studies on the effects of nutrients, particularly of vitamins and minerals on vision and on functions of the eye. The studies aim to examine the role of vitamin A in the development and function of the retina and the cornea, as well as the effect of dietary components on cataract formation. Vitamin A and protein/calorie malnutrition are

also being studied as causes of blindness in children. Studies of patients with pigmentary tapetoretinal degeneration have revealed elevated serum levels of various hormones, copper, and zinc, while studies of gyrate atrophy of the retina have revealed elevated serum ornithine levels. The Royal College of Surgeon (RCS) rat is a model for retinitis pigmentosa. Studies indicate that the rat shows prolific reproduction and improved growth with supplemental vitamins A and E, fat, and zinc.

Finally, it is important to note the activities of the Division of Research Services (DRS) at the NIH. The primary objective of the DRS laboratory animal nutrition research program is to improve the quality of laboratory animals being produced for research by improving their nutritional status. A series of feeding trials are designed to evaluate new diets and to determine the nutrient requirements of various strains or stocks of animals within a species. Data obtained from these studies are the basis for formulating diets having optimal nutrient concentrations for specific animals. These data are used to develop standard reference diets for use throughout NIH and the biomedical research community. During the past year, a complete marmoset diet, a laboratory rodent diet with a low potential for chemical contaminant concentrations, and improved diets for guinea pigs have been developed. Diets with either deficient or excess nutrient concentrations are evaluated to provide animal models with nutrition-related diseases for study by NIH investigators. Studies are also conducted to develop satisfactory diets for the various animal species being introduced to biomedical research as new animal models.

The intramural nutrition research program of NIH complements and augments the extramural program by concentrating on research particularly relevant to the mission of the Institutes that utilize the facilities and scientific expertise available on the NIH campus.

NUTRITION RESEARCH TRAINING

The NIH supports training in biomedical and behavioral nutrition research in both the extramural and the intramural programs. Table VIII summarizes the obligations and the number of persons who received training in FY 1980.

Table VIII

NIH TRAINING IN NUTRITION, FY 1980

Institute	MD Degree	PHD Degree	Other Degree*	Pre-Doc	Number of Persons Trained	FY 1980 Obligations (Dollars in thousands)
EXTRAMURAL:						
Institute Training Grants						
NCI		2		6	8	$ 158
NHLBI	5	48		17	70	1,206
NIA			4	3	7	16
NIAID	2	2			4	10
NIAMDD	12	9		47	68	814
NICHD	5	2	1		8	248
NIDR		5	3		8	150
NIEHS		8		10	18	167
NIGMS	23	2		68	93	432
Subtotal	47	78	8	151	294	$3,201
Individual Fellowships						
NEI		3	2		5	92
NHLBI	2	2			4	43
NIA		5			5	19
NIAMDD	5	21			26	305
NICHD	3	5			8	138
NIDR			1		1	18
NIGMS	2				2	13
Subtotal	12	36	3	0	51	$ 628
EXTRAMURAL SUBTOTAL	59	114	11	151	335	$3,829
INTRAMURAL						
NHLBI	2	4			6	$ 85
NIAMDD	2	4	1		7	107
NICHD	6	—	1	—	7	308
INTRAMURAL SUBTOTAL	10	8	2	0	20	$ 500
NIH TRAINING TOTAL	69	122	13	151	355	$4,329

* Other Degree includes MD/PHD, PHD/DDS, DDS, DVM, DSc, etc.

The number of trainees in human nutrition research supported by the NIH increased by more than 50 percent between FY 1978 and FY 1979 and increased slightly between FY 1979 and FY 1980 as shown in table IX.

Table IX
NIH SUPPORT OF NUTRITION RESEARCH TRAINING, FY 1978 - 1980
(in thousands of dollars)

	FY 1978		FY 1979		FY 1980	
	Number	Cost	Number	Cost	Number	Cost
Extramural Training	169	$2,419	297	$3,023	335	$3,829
Intramural Training	31	668	41	$1,014	20	500
Total	200	$3,087	338	$4,037	355	$4,329

The research training activities in the extramural and the intramural programs are described below.

Extramural Training

Within the extramural program, two basic mechanisms are used for nutrition training support: institutional awards and individual awards.

The Institutional National Research Service Awards, commonly called "training grants," are designed to enable institutions to make training awards to individuals selected by them for predoctoral and postdoctoral research training. In FY 1980, this mechanism was used to train 284 persons in nutrition, for a total obligation of $3,201,000. A total of 8,878 full time equivalent research trainees were supported through training grants by NIH in FY 1980 for a total obligation of $141,719,000. The number of trainees in nutrition supported by training grants is 3.2 percent of all the trainees supported by this mechanism by NIH. This support represents 2.3 percent of NIH obligations for FY 1980 training grants.

The Postdoctoral Individual National Research Service Awards, called "fellowships," are awarded to provide postdoctoral research training to individuals to broaden their scientific background and extend their potential for research. In FY 1980, the NIH supported 51 fellowships in nutrition for a total obligation of $628,000 out of a total of 1786 fellowships with a total obligation of $34,669,000. The number of fellowships in nutrition was 2.8 percent of the total number for NIH and incurred an obligation of 1.8 percent of the total NIH obligation for fellowships. Therefore, in the extramural nutrition training program for FY 1980, including both training

grants and fellowships, a total of 335 persons were supported at a total obligation of $3,829,000. Thus, 3.1 percent of all NIH trainees were receiving training in nutrition in FY 1980. This effort accounted for 2.2 percent of NIH training obligations.*

Examples of areas in which the trainees carried out their work include the following:

Experimental and clinical nutrition

Multidisciplinary problems of human health & food production

Effect of peptide hormones on food intake and body weight

Nature of feeding-induced rhythmicity in intestines

Pregastric satiety in experimental hyperphagia

Circadian rhythms and control of food intake

Regulation of lipolysis in animal and human obesity

Ontogeny of ingestion: early learning and sensory function

Behavior, nutrition, hormones and seasonal rhythms

Nutrition and arteriosclerosis

Role of insulin and diabetes mellitus in HDL metabolism

Blood pressure, lipids, and the vegetarian diet

Cardiac nutrition and pharmacology

Epidemiology of cancer

Carcinogenesis and drug development

Research in burns and trauma

Nutrition and health status

Control of lipogenesis and obesity

Influences on preadipocytes in culture

Central & peripheral mechanisms of energy homeostasis

Bioenergetics of fasting and lactation

Studies of dietary effects on human adipose tissue

Ovarian hormones, food intake and lipid metabolism

Control of food intake: focus on nutrition and behavior

Metabolic regulation and weight control

Recovery of feeding behavior following brain damage

Lipid metabolism and atherosclerosis

Studies on lipoprotein metabolism

The interaction of dietary cholesterol and LDL on immune function and selected antifungal drugs.

Nutrition in cardiovascular disease

Plasma cholesterol ester exchange activity

Nutrition and oral health

Nutrition in relation to problems of oral biology

* All figures referring to overall NIH Research Training were taken from NIH Research Training, prepared by NIH/ADA/DFM/BFPB as of March 24, 1981.

Dietary zinc and oral epithelial changes

Calcium and control of lacrimal gland secretion

Penetration and metabolism of retinoids in the cornea

Vitamin E requirements during parenteral nutrition

Target organ insensitivity to $1,25\text{-}(OH)_2\text{-}D_3$

Cutaneous formation and administration of $1,25\text{-}(OH)_2\text{-}D_3$

Mitochondrial aspects of pyridoxine metabolism

The chemistry of vitamin B_{12}

Mechanisms of the molybdenum/copper antagonism

The copper deficient rat lung as a model for emphysema

Aging and metabolism

Age-related influences of fasting and cold stress

Pediatrics, prematurity, and the newborn

Nutritional effects on polymorphonuclear function

Environmental and food toxicology

Effects of vitamin E on ocular angiopathy

Vitamin A transport in ocular and other tissues

Experimental xerophthalmia & keratomalacia in vitamin A deficiency

Synthesis and metabolism of vitamin D analogs

Characterization of vitamin D-like substance

Vitamin B_6 and tryptophan metabolism in pregnancy

The effect of methionine deficiency on carnitine metabolism

Growth hormone and somatomedin in models of malnutrition

Bilirubin glucuronyl transferase in intestinal mucosa

Evaluation of glucose metabolism in aging humans

Brain monoamines, aging and tumorogenesis

Child malnutrition: Sudest Island Region, New Guinea

Nutrition and gastroenterology

Nutritional state on nuclease digestion of chromatia

Dietary zinc and oral epithelial changes

Intramural Training

Within the NIH intramural program, three Institutes, NHLBI, NIAMDD, and NICHD, supported training of 20 scientists at an obligation of $500,000 in FY 1980.

The intramural trainees are working in the following areas:

Fatty acid and fat soluble vitamins in cystic fibrosis

Transport of lipids, hormones and enzymes in tissue cells and membranes

Diabetes

Methylmalonic aciduria

Growth retardation in children with cystinosis

Obesity

Role of free and lipid-bound inositol in brain and cell membranes

Hypoglycemia

Biochemical studies of heptatic and intestinal function

Relation of prostaglandin to lung development

SPECIAL INTEREST AREAS IN NUTRITION

Biomedical and behavioral nutrition is a complex science, which has many aspects. Poor nutrition contributes to diseases such as atherosclerosis, obesity, hypertension, dental caries, iron deficiency anemia, diabetes mellitus, osteoporosis, and some forms of cancer; it detracts from the health of pregnant women, particularly adolescents; and it often leads to poor fetal development and low birth weight babies.

In FY 1980 many of these aspects of biomedical and behavioral nutrition were considered by the NCC to be particularly important so as to merit special attention. Fifteen special interest areas in nutrition were identified by the NCC, and grants and contracts pertaining to each area were designated by the program staff of the Institutes and DRR. These specialty areas are:

Nutrition and Prevention of Disease

Nutrition and Genetics

Behavioral Studies in Nutrition

International Research in Nutrition

Epidemiological Research in Nutrition

Nutrition and Obesity

Nutritional Status

Nutrition and Aging

Child and Infant Nutrition

Maternal Nutrition

Total Parenteral and Enteral Nutrition

Nutrition Education for the Public

Nutrition Education for Professionals

Nutrition Education Research

Research on Vitamins

Table X presents the number of grants or contracts in each area; the expenditure of the nutrition component of grants and contracts in that area; and the percentage of the total FY 1980 nutrition obligation of $139,121,000. Each project, i.e. a grant or contract, could appear in more

than one special interest area. For example, a study on nutrition and genetics that has as its main objective to prevent the onset of disease in a child would appear in the following categories: nutrition and genetics, nutrition and prevention, and child and infant nutrition. Therefore, the sum of each column in this table will exceed the corresponding quantities for the nutrition program as a whole.

Table X

SPECIAL INTEREST AREAS IN NUTRITION -- SUMMARY TABLE*

Special Interest Area In Nutrition	Number of Grants or Contracts	Cost (Dollars in thousands)	Percent** of Total Cost
Prevention of Disease	692	$ 59,828	43.0
Genetics	146	12,568	9.0
Behavioral Studies	237	22,736	16.3
International Research	68	4,735	3.4
Epidemiological Research	190	18,446	13.3
Obesity	163	9,804	7.1
Nutritional Status	276	31,055	22.3
Aging	118	8,150	5.9
Child and Infant	241	22,858	16.4
Maternal	75	5,493	3.9
Total Parenteral and Enteral Nutrition	64	5,760	4.1
Education for the Public	29	3,220	2.3
Education for Professionals	48	4,606	3.3
Education Research	63	11,320	8.1
Research on Vitamins	302	19,748	14.2

* A grant or contract may be assigned to several special interest areas.

** The total cost of the nutrition program in FY 1980 is $139,121,000.

The NIH nutrition program is presented in terms of these 15 special interest areas because of the scientific and political interest that has surrounded these particular aspects of nutrition research in the most recent past. A detailed description of the research funded in each of the special interest areas is given in Appendix C of this report. The total obligation for each area in FY 1980, the percentage that each area constitutes of the entire FY 1980 nutrition program, and a definition of the kind of research that falls under each area is presented below.

NUTRITION AND PREVENTION OF DISEASE

Approximately 43 percent of the nutrition research supported in FY 1980 by the NIH was concerned with the prevention of disease or was directed toward obtaining information that would lead to preventive measures. The total obligation in this category was $59.8 million; support was provided by DRR, NCI, NEI, NHLBI, NIA, NIAID, NIAMDD, NICHD, NIDR, and NIEHS.

The working definitions used by the NCC for prevention are as follows:

> Primary prevention. Actions to promote health or undertaken prior to the development of disease.
>
> Secondary prevention. Detection of disease in its early (asymptomatic) stages and intervention to arrest its progress.
>
> Tertiary prevention. Intervention after the development of a clinically manifest disease in order to reverse or arrest its progression.

Prevention in general was singled out by the Department as a research initiative, thus, nutrition and prevention of disease has been an area of prime importance in the NIH nutrition program.

NUTRITION AND GENETICS

Biochemical genetics has advanced our understanding of the interactions between heredity and nutrition, of the development and treatment of certain diseases, and of normal development and disease prevention. In the genetics and nutrition program at the NIH, research on the effects of nutrition and dietary intervention on inherited diseases and conditions is supported by the DRR, NCI, NEI, NHLBI, NIA, NIAMDD, NICHD, NIEHS, and NINCDS. The obligation in this special interest category was $12.6 million or 9.0 percent of the total cost of the nutrition program in FY 1980.

Genetics and nutrition research is concerned with such areas as: inborn errors of metabolism, including vitamin dependencies; determinations of cellular function, especially DNA repair mechanisms; chromosomal aberrations; protein synthesis; metabolic disorders; obesity; and the role of dietary control of inherited diseases, including the hyperlipoproteinemias, diabetes, and sickle cell anemia. The wide range of research in

nutrition and genetics has received considerable attention, and due to the advances in other scientific disciplines such as molecular biology, cell biology and genetics, significant advances have been made.

BEHAVIORAL STUDIES IN NUTRITION

The nutritional status of an individual depends not only on the physiological regulation but also on the motivation controlling food intake and food selection. Regulation and motivation, in turn, are governed by a set of peripheral variables (taste, smell, gastric factors, and humoral and metabolic factors) that are integrated in the central nervous system where they may be greatly influenced by learning habits, and social, cultural, and religious values. The very important role of learning and habit in food preferences and aversions is thus an essential aspect of this part of nutrition research. Research is also conducted on the ways in which excess or deficient intakes of various foods or nutrients may influence certain behaviors. In FY 1980, the NIH funding level for behavioral studies in nutrition was over $22.7 million, or 16.3 percent of total nutrition research, and was supported by DRR, NCI, NHLBI, NIA, NIAMDD, NICHD, NIEHS, and NINCDS. Behavioral studies in nutrition have unveiled many of the psychosocial motivations behind various eating patterns.

INTERNATIONAL RESEARCH IN NUTRITION

The U.S. has a number of mechanisms that permit the support of research in other countries and encourage foreign investigators to carry out research in the U.S. Support for international nutrition is funded by DRR, NCI, NEI, NHLBI, NIAID, NIAMDD, NICHD, NIEHS, and FIC at a cost of 4.7 million, or 3.4 percent of total nutrition support at NIH.

The implications of research results of nutrition studies in one country may contribute to solving the problems of another, if effective mechanisms for scientific communication and follow-up studies can be established and maintained. International nutrition research support involves both developed and developing countries. The affluent sections of the populations in developing countries have nutritional problems similar to those of the developed countries. The nonaffluent sections that comprise the majority of the populations in the developing countries suffer from malnutrition--with maternal and infant malnutrition accounting for a large proportion.

A thorough review and detailed study of the NIH support for international nutrition research in FY 1980 is given as Appendix D of this report.

EPIDEMIOLOGICAL RESEARCH IN NUTRITION

The NIH is the lead agency in epidemiological research in nutrition. The role of food habits and the socioeconomic factors that influence food selection in health and disease are important components in epidemiological

research and various clinical trials using epidemiological tools are under way. In FY 1980, the NIH provided $18.4 million to support epidemiological research in nutrition; this is equal to 13.3 percent of total nutrition research. Programs in this area include those of the DRR, NCI, NHLBI, NIA, NIAMDD, NICHD, and NIEHS.

The various NIH projects in epidemiology can be grouped in five basic categories: 1) evaluation of nutritional epidemiological procedures, 2) studies of early nutrition on physical and psychological development in defined populations, 3) nutrition-related epidemiological studies on maturation and reproductive function, 4) nutrition surveys of target or special population groups, and 5) epidemiological correlations of food intake to disease states. Epidemiological studies dealing with diet and nutrition have unveiled the various relationships between diet and cancer, and diet and cardiovascular disease. Epidemiological research has uncovered many of the tools and methods needed to assess how food habits and socioeconomic factors influence food selection.

NUTRITION AND OBESITY

Nutrition research on the biomedical and behavioral aspects of obesity is an important area of consideration at the NIH. In FY 1980, the DRR, NCI, NHLBI, NIA, NIAMDD, NICHD, and NINCDS supported research in obesity for a total obligation of $9.8 million, or 7 percent of total nutrition research.

Obesity is a major public health problem in the United States, affecting both children and adults. According to national statistics, one out of three Americans is obese. Of all women between the ages of 37 and 70 approximately 30 to 40 percent are considered obese (at 20 percent or more over their desirable weights as suggested by life insurance statistics). Thirty percent of men in this country are considered obese, with some subgroups reaching even higher percentages of obesity. Children today are, on the average, 50 percent heavier than they were a generation ago. Furthermore, obesity is either a risk factor in, or is associated with, a number of diseases, including diabetes, hypertension, coronary heart disease, osteoarthritis, complications of pregnancy, and some infections.

NUTRITIONAL STATUS

In FY 1980, research on nutritional status was supported by the NIH for a total of $31 million or 22.3 percent of total nutrition research. Individual programs in this area include those of DRR, NCI, NHLBI, NIA, NIAID, NIAMDD, and NICHD.

Research on nutritional status supported by the NIH includes studies that relate to requirements for essential nutrients in terms of nutritional status throughout the entire life cycle, from fetal life to infancy, childhood, adulthood, and the aged. Such studies are carried out in normal subjects and in patients with various disease states. Specifically,

NIH-supported research in nutritional status includes research into the methods that measure nutrient concentrations; biochemical, anthropometric, and maturational indices of nutritional status; dietary recall; and food composition studies. Within the Federal Government, the NIH is the major agency for support of nutritional status research and for the development of data that are used in nutritional surveys.

Nutritional status assessment has been designated as a particular interest by Congress and therefore the Department, as evident from the congressional request for an Implementation Plan for a National Nutritional Status Monitoring System.

NUTRITION AND AGING

The Division and Institutes supporting research in FY 1980 on nutrition in aging are DRR, NCI, NEI, NHLBI, NIA, and NIAMDD in the amount of $8.2 million or 6 percent of total nutrition research.

Heredity establishes the foundation for the body's ability to cope with the psychophysiological changes that occur with aging, but good nutrition may make the foundation stronger and more resistant to such changes. A major question for scientists today is whether nutritional needs change significantly after the first 50 years of life; and if so, how do these needs change and what specific nutrients are involved? Both laboratory and clinical studies examine the effect of aging on the need for vitamins, mineral metabolism and taste acuity, biochemical changes in the brain, and protein or amino acid metabolism and bone density, as well as fat metabolism and atherosclerosis.

CHILD AND INFANT NUTRITION

Research on the role of nutrition in maintaining the health of infants and children is a very important part of the nutrition program at NIH. In FY 1980, $22.8 million or 16.4 percent of total nutrition research was spent by DRR, NCI, NHLBI, NIAID, NIAMDD, NICHD, NIDR, NIEHS, AND NINCDS to support research in this area.

Every child born is a product of his or her genetic background that must bear the environmental influences of our time. Nutrition is one factor that plays a major role in the proper growth and development of infants and children. Women in the childbearing years are advised to maintain adequate body stores of vitamins and minerals so that their body is ready to handle the additional demand for nutrients that comes with pregnancy and lactation. In recent years, attempts to determine specific nutritional demands and to uncover the possible role of nutrition before and immediately after birth have led to exploring the environment of the fetus and the neonate.

MATERNAL NUTRITION

In FY 1980, research on maternal nutrition as supported by DRR, NHLBI, NIA, NIAMDD, NICHD, NIDR, and NINCDS totalled $5.5 million, or 3.9 percent of total nutrition research at NIH. It is now an accepted tenet that the nutritional status of the mother affects not only the growth and development of the child, but her own health as well. Many of the related nutritional questions, however, remain unanswered and many problems remain to be solved. Studies with an emphasis on the relationship of nutrition to reproduction attempt to analyze the effects of vitamins on reproductive function and morphology, the consequences of malnutrition on reproduction and lactational amenorrhea, the relationship between oral contraceptive use and vitamin metabolism, the role of nutrition in population dynamics, and the establishment of maternal nutritional requirements during pregnancy and lactation that assure optimal growth and functional development of the fetus and newborn.

TOTAL PARENTERAL AND ENTERAL NUTRITION

The NIH supports and conducts research and training in various aspects of total parenteral nutrition (TPN). The DRR, NCI, NIA, NIAID, NIAMDD, NICHD, and NIGMS support research in this area. In addition to extramural support the NCI also supports studies in TPN in its intramural program. Total research obligations in the extramural program totalled $5.7 million for FY 1980 or 4.1 percent of total nutrition research.

The extramural research support includes studies on the determination of nutritional requirements of patients that receive hyperalimentation, as well as studies on the methods to define precisely the nutritional status of patients. Such studies are carried out in low birth weight infants, in children hospitalized because of trauma and burns, in patients with cancer and gastrointestinal disorders, as well as on those who have undergone surgery, and in the elderly. Total parenteral and enteral nutrition research addresses the special needs of the patient, especially the critically ill.

NUTRITION EDUCATION FOR THE PUBLIC

Although the primary mission in nutrition of the NIH is in the support of biomedical and behavioral nutrition research and training, nutrition education for the public is an integral part of many programs. The total obligation for FY 1980 was $3.2 million or 2.3 percent of total nutrition research. Two Institutes have specific mandates for information and education programs: the NCI and the NHLBI. Nutrition education for the public is also provided through programs funded by the DRR, NIAID, NIAMDD, NICHD, NIDR, and the NCC Office. Efforts are continually made to translate the results of nutrition research into practical information for the American public. The aim of this nutrition education effort is to help the public select a healthy diet suitable to individual needs throughout the life cycle.

NUTRITION EDUCATION FOR PROFESSIONALS

In FY 1980 the NCI, NHLBI, NIA, NIADDK and NICHD support for nutrition education for professionals accounted for about 3.3 percent or $4.6 million of the NIH nutrition program. Two Institutes, namely NCI and NHLBI, have specific mandates for education programs for professionals. Nutrition education for professionals is provided by the NIH through various means. The latest developments in nutrition research are published in such medical and scientific journals as the Journal of the American Medical Association, The American Journal of Clinical Nutrition, The Journal of Pediatrics, The Journal of the National Cancer Institute, The Journal of Clinical Investigation, The New England Journal of Medicine, and many other journals. An extensive effort in professional education includes continuing education courses that are provided for paramedical personnel, medical students, nurses, residents, practicing physicians and research scientists. Much of this effort is provided through the Clinical Nutrition Research Units (CNRU's).

NUTRITION EDUCATION RESEARCH

Nutrition education research is a component of a number of intervention programs and clinical trials, the Clinical Nutrition Research Units, and special projects carried out by NICHD. In FY 1980, the DRR, NCI, NHLBI, and NICHD spent $11.3 million or 8.1 percent of total nutrition research in this area. The NHLBI supports the following programs: The Stanford Five County Heart Disease Prevention Program, the Minnesota Heart Program, and the Pawtucket Heart Program. The Multiple Risk Factor Intervention Trial (MRFIT) and the Coronary Primary Prevention Trial are two major clinical trials that include nutrition education research, while the National High Blood Pressure Education Program (NHBPEP) is a broad based educational effort with dietary management as one focus to reduce hypertension. In addition, nutrition education research is supported by the CNRU's funded by NCI and NIAMDD.

RESEARCH ON VITAMINS

The NIH supports and conducts research on the various metabolic functions of all essential nutrients. One area of particular interest is research on vitamins supported by the DRR, NCI, NEI, NHLBI, NIA, NIAID, NIAMDD, NICHD, NIDR, and NINCDS. Research on the fat-soluble vitamins includes studies on vitamins A, D, E, and K, while research on the water-soluble vitamins includes studies on vitamin C (ascorbic acid), thiamin (B_1), riboflavin (B_2), niacin, pyridoxine (B_6), cobalamin (B_{12}), folic acid, biotin, and panthothenic acid. Research in this special interest area totalled $19.7 million or 14.2 percent of total nutrition research at the NIH. Research on the metabolism, function, and possible interactions of vitamins is a major area of nutrition research.

II.

NUTRITION COORDINATING COMMITTEE

Nutrition is an important, crosscutting program area within the NIH. For this reason, the nutrition program is coordinated through the Nutrition Coordinating Committee that operates out of the Office of the Director and is advisory to the Director. The committee is the focus for the review of nutrition research priorities and training, their coordination, and for the development of the NIH program in biomedical and behavioral nutrition research and training. This focus minimizes duplication of effort among the Institutes and identifies areas where research, research training and manpower development in nutrition need to be advanced.

COMMITTEE STRUCTURE

The Nutrition Coordinating Committee (NCC) operates out of the Office of the Director and is advisory to the Director, NIH. The membership of the NCC consists of representatives from the 11 Institutes and the Division that support nutrition research. Additional NIH offices, other agencies of the Public Health Service and the Department of Health and Human Services, and the Office of Science and Technology Policy in the Executive Office of the President have liaison representatives to the Committee. As of September 8, 1980, the NCC was composed of 3 officers, 23 members and alternates, 10 liaison representatives and alternates from interested offices within the NIH, and 9 liaison representatives and alternates from other Federal agencies (see pages vii and viii).

The Committee, established in 1975, reviews and comments on the plans, execution, and results of pertinent Bureau, Institute, and Division research efforts relating to nutrition in order to develop the Annual Report of the NIH Program in Biomedical and Behavioral Nutrition Research and Training. In addition to staffing the NCC, the Office staff provides information requested by the Office of the Director, and represents NIH in numerous activities involving nutrition research at DHHS, the Office of Science and Technology Policy, other Federal and non-Federal agencies, industry, and professional societies. The NCC Office also maintains information on national and international nutrition meetings and conferences.

NCC meetings are normally held once a month and are attended by the members, liaison representatives, and Committee Office staff. In addition to the regular business of the Committee, special presentations on subjects of current interest to the NCC are frequently made by scientists from other agencies or groups. In FY 1980, Special Scientific Seminars were presented during the last hour of each meeting by intramural and visiting scientists engaged in nutrition research at the NIH.

NCC SUBCOMMITTEES

In addition to the Committee activities a number of special activities were carried out through two subcommittees: The Program Subcommittee and the Subcommittee on Nutrition Education.

The Program Subcommittee is chaired by the NCC Chairman. The Subcommittee draws its membership from the NCC representatives of the NCI, NEI, NIAID, NIAMDD, NICHD, and NCC Office staff.

The charge of the Program Subcommittee is:

- to develop the agenda for each NCC meeting
- to formulate the report of the NIH Program in Biomedical and Behavioral Nutrition Research and Research Training

- o to develop Program Announcements
- o to consider nutrition conferences
- o to discuss the advisability of outside speakers at NCC meetings
- o to serve as a primary reviewer for nutrition applications submitted through the Fogarty International Center.

The Subcommittee on Nutrition Education includes representatives from various Institutes, the Clinical Center, and the Office of Communication. As of September, 1980, the membership of the Subcommittee consisted of: Dr. Diane Fink, Chairman; Karen Donato, Executive Secretary; Ernestina Bou, Clinical Center; Jeanne Tillotson, NHLBI; Dr. Thorsten Fjellstedt, NICHD; Dr. David Wolff, NIDR; Marjorie Zukel, NIAMDD; and Gerald Hecht, Marc Stern, and Donald Ralbovsky, Office of Communication.

The charge of the Subcommittee on Nutrition Education is:

- o To review NIH nutrition publications designed for the public
- o To develop public service announcements
- o To develop the NIH Newsletter on Biomedical and Behavioral Nutrition Research and Training (This activity is currently pending).

COMMITTEE ACTIVITIES AND ACCOMPLISHMENTS IN FISCAL YEAR 1980

SCIENTIFIC SEMINARS

In order to highlight research in nutrition carried out by intramural scientists at the NIH and to keep the NCC representatives informed of research developments in nutrition, the NCC inaugurated a new program series called Scientific Seminars in Nutrition. The Seminars were presented during the second hour of the NCC monthly meeting. During FY 1980, the following eight Scientific Seminars in Nutrition were presented:

1) "The Effects of Obesity on Mortality in The Baltimore Longitudinal Study of Aging" was presented by Dr. Reubin Andres, Clinical Director of NIA, at the January 24, 1980 NCC meeting. A summary of his presentation is given below:

Several studies have been conducted that look at the possible relationship of increased mortality with obesity. Obesity is a well-recognized risk factor for the development of a number of common, life-shortening illnesses such as coronary heart disease (CHD), hypertension, and diabetes. In a less direct way, obesity also influences other risk factors, such as in the case of CHD, with its effect on hyperlipidemia or hypertension. The effect of obesity is coupled with the many aging processes that lead to changes in body composition, changes in the arterial wall, etc. that alone influence CHD risk factors. Since CHD is a major killer, especially as people age, it would seem inevitable that obesity would be strongly associated with increased mortality.

A review of the world's literature on the association of obesity and mortality shows a lack of effect of obesity on mortality until marked degrees of overweight are present. In epidemiological studies, such as the "1959 Build and Blood Pressure Study," no effect of overweight occurs until body weight exceeds the desirable weight by some 20 to 30 percent. Data from the Framingham Study and a study done in Alameda County, California, show no linear positive relationship between obesity and mortality. In fact, for men 50 years old, there is a negative correlation. The Chicago Peoples Gas Company Study reported that the optimal weight for someone in the fifties, who is 69 inches tall, is 198 pounds, which is approximately 25 to 32 percent above the desirable weight.

The studies on obesity employ various indices of obesity; one study of 55-64 year old subjects conducted in England computed a Body Mass Index after converting height and weight to log units. Mortality was highest in the lighter subjects. In a Duke University study of persons 60 to 94 years of age the Body Mass Index was computed on the basis of height in inches and weight in pounds. In this case 44 percent overweight for men or 54 percent overweight for women did not appreciably influence mortality. Approximately 16 studies report similar results; obesity is not associated with increased mortality.

On the other hand, actuarial data from the insurance industry and data from the recently published American Cancer Society study appear to contradict this conclusion. The major difference, however, is due to the fact that these studies report excess mortality with respect to the average weight of the subjects. Since the average weight of middle-aged individuals is some 15 to 20 percent higher than the desirable weight, the discrepancy between those studies and the rest of the literature is, in fact, more apparent than real.

The discrepancy remains, however, between the harmful effect of mild and moderate obesity on important specific illnesses and the lack of effect of equal degrees of obesity on total mortality. The possible explanations that have been given for this phenomenon are: the survival of a serious illness, such as cancer or myocardial infarction, might be better when one is obese; obesity might be associated with certain beneficial variables such as nonsmoking; some personality types tend to be obese and that personality type may tend to live longer; some unknown nutrient beneficial to survival from specific illnesses might be present in small amounts in food; some data artefact might be present in the study in which the sick obese people do not get recruited into the study while the sick and lean people do. None of these possible explanations are really tenable as major factors.

Dr. Andres concluded that a possibility exists that there may be benefits of obesity that balance its harmful effects. The risks of obesity have been extensively investigated, but the potential benefits of lesser degrees of obesity have received essentially no attention from epidemiologists, clinical investigators, and laboratory scientists.

2) "The Role of Intestine in Nitrogen Metabolism and Plasma Apolipoprotein Biosynthesis: Vascular Perfusion Studies in the Rat" was presented by Herbert G. Windmueller, Laboratory of Nutrition and Endocrinology, NIAMDD, at the February 28, 1980 NCC meeting. A summary of his presentation is given below:

Research advances in gastrointestinal absorption have been hindered due to the absence of a good animal model to study vascular perfusion of the small intestine. The Laboratory of Nutrition and Endocrinology, NIAMDD, has developed two vascular perfusion methods for rat small intestine. The first method involves vascular perfusion of the entire small intestine, isolated and removed from the animal. The second method involves an autoperfused segment of small intestine in vivo in which the arterial, neural, and lymphatic connections to the segment remain intact while the venous outflow from the segment is collected. Both methods are well suited for quantitative studies of intestinal transport, intestinal metabolism of vascular and luminal compounds, and intestinal biosynthesis of specific proteins and other components.

Studies with the perfused intestinal preparations and also with intact animals have identified the small intestine as the major site for the metabolism of circulating glutamine, the most abundant plasma amino acid.

It has been shown that in most laboratory animals, 20-30 percent of the total plasma glutamine is extracted in each blood pass through the intestinal vasculature, and that plasma glutamine is the source for 35 percent of the total CO_2 produced by the jejunum of post absorptive rats, while only 7 percent comes from glucose. Glucose had previously been considered the major energy source for the intestine. Plasma glutamine is also an important metabolic substrate for the intestine of fed rats. Glutamine utilization is localized in the villus and crypt cells of mucosal epithelium and is initiated by a phosphate dependent glutaminase with a higher affinity for glutamine. The physiological functions served by intestinal glutamine metabolism include: a) providing a major source of energy for the intestine; b) providing indirectly an endogenous source of arginine by supplying citrulline for arginine biosynthesis in the kidneys and other tissues; c) converting nitrogen released to blood by muscle into precursors for urea biosynthesis in the liver. The quantity of glutamine nitrogen processed daily by the intestine in fasted rats accounts for nearly 40 percent of the urea nitrogen excreted.

In addition, the intestine plays a role in the biosynthesis of apolipoproteins. Lipids are transported throughout the body as large lipoprotein complexes containing a specific group of proteins known as apolipoproteins (apoLP). The apoLP synthesized by each organ have been identified. The liver has been found to synthesize all of the apoLP in the following progression, apo E > apo B > apo C > apo A-1 > apo A-IV, while the intestine was found to synthesize apo A-1 > apo A-IV > apo B > apo C, with little or no apo E. Since most apoLP are synthesized to some extent by both the liver and the intestine, several studies, using two different methods, assessed the relative contribution of each organ. Results obtained from the two complimentary methods seem to indicate that 19 percent of the total plasma apoLP pool is synthesized by the intestine and 81 percent by the liver. The percent intestinal contribution to individual plasma LP is as follows: apo A-IV (59%), apo A-I (56%), apo B (16%), apo C-II (10%), apo C-III-0 (7%), apo C-III-2 (1) (< 10%), apo C-III-3 (< 1%), apo E (< 1%). Since in the rat, apo A-I and apo A-IV are the major protein constituents of plasma high density lipoprotein (HDL), the intestine is an important contributor to this lipoprotein class.

Dr. Windmueller concluded that in addition to its well known digestive and transport functions, the small intestine has important metabolic and biosynthetic functions in the body.

3) "Interrelationships of Vitamins A and E in Maintenance of Retina and Formation of Lipofuscin" was presented by W. Gerald Robison, Jr., Experimental Pathology Section, Laboratory of Vision Research, NEI, at the March 27, 1980 NCC meeting. A summary of his presentation is given below:

Many studies have shown the relationship of vitamin A to vision, particularly night blindness. More recent studies have begun to consider not only vitamin A, but the interrelationship of vitamins A and E in the maintenance of the retina. Approximately 90 percent of the vitamin A stored in the retina is concentrated in the pigment epithelium, a single layer of cells

strategically located between the photoreceptor cells and the rich capillary bed of the choroid in the eye. The photoreceptor cells are known to utilize large quantities of vitamin A.

Studies have been done to determine whether cytoplasmic lipid droplets function as normal sites of intracellular vitamin A storage. After injecting labeled retinyl acetate into mice, the cytoplasmic lipid droplets in the stellate cells of the liver and in pigment epithelial cells of the retina did appear as normal sites of intracellular vitamin A storage. In the stellate cells of the liver a dose-related increase in the number and size of lipid droplets storing vitamin A appeared, while in the pigment epithelium a more conservative increase in similar lipid droplets occurred. This was not seen in other cells of the retina. These lipid droplets probably represent physiological sites of vitamin A storage that are important for the maintenance of photoreceptor cells by the retinal pigment epithelium. Along with the vitamin A storing lipid droplets, peroxisomes also were distributed along the basal and lateral cell surfaces of the pigment epithelial cells where receptors for plasma retinol binding protein have been reported. This suggests that peroxisomes may play a role in the reactions related to the esterification and sequestering of vitamin A in the retinal pigment epithelium.

Recently, research has been initiated on the interactions of vitamin A and vitamin E in their role of maintaining the normal structure and function of the retina. Rod outer segment membranes contain unusually high proportions of polyunsaturated fatty acids, and subsequently, it has been suggested that they are susceptible to oxidation. Apparently, high indigenous concentrations of the antioxidant vitamin E normally protects retinal membranes from the oxygen in their environment.

Research has shown that rats deprived of vitamin E for twenty weeks exhibit marked swelling of rod outer segments and structural disruption of their membranes concomitant with a dramatic accumulation of lipofuscin, aging pigments in the pigment epithelium. The accumulated aging pigments probably represent highly peroxidized breakdown products of the photoreceptor membrane lipids. After 35 weeks, an irreversible loss of many photoreceptor cells occurs, concomitant with a drop in liver vitamin A storage levels and loss of vitamin A specific fluorescence of the retina. Apparently, low levels of vitamin E led to greater peroxidative losses of stored vitamin A as well as losses of membrane lipids in both the retina and the liver.

In experiments with rats made deficient in both vitamin A and vitamin E, after 35 weeks, 90 percent of the visual cells of the retina were lost, while those deficient in either vitamin alone lost between 16-30 percent. The accelerated retinal damage in doubly deficient retinas probably resulted from accelerated oxidative loss of tissue vitamin A when the antioxidant effects of vitamin E were missing. Rats deficient in both vitamins had much less accumulation of lipofuscin granules in the pigment epithelium than in rats deficient in vitamin E alone. Two hypothesis behind this phenomenon are: 1) vitamin A could be involved in lipofuscin production directly; or 2) vitamin A influences phagocytosis of photoreceptor membranes

which become peroxidized to form lipofuscin. Experiments in rats without photoreceptor cells indicate that some of the aging pigment that accumulates when vitamin E is deficient and vitamin A is present, represents peroxidation products of vitamin A.

Dr. Robison concluded that the role of vitamins E and A are closely linked in the retina. The lack of either leads to irreversible structural damage, and the lack of both accelerates the damage and results in unusual formation of aging pigment known as lipofuscin. Such findings on the specific roles of vitamins in retinal function are important, especially for countries where malnutrition leads to several blinding diseases. An adequate supply of vitamin E should permit a generally malnourished person to store more vitamin A in the retinal pigment epithelium and perhaps prevent the blindness, which otherwise might be unavoidable even when some vitamin A is available.

4) "Breast Milk, Infections and Nutrition" was presented by Dr. Lars Hanson, Fogarty Scholar-in-Residence, FIC, at the April 24, 1980 NCC meeting. A summary of his presentation is given below:

Several studies show that weight loss appears in children in developing countries in direct relation to the occurrence of infections. Infection, and not necessarily a lack of food, may be the major factor in undernutrition in areas of the world where exposure to infectious agents is widespread. Sick infants lose nutrients through diarrhea and vomiting, their appetites decline, and the food they do eat is not utilized efficiently by the body. This is most striking after weaning when morbidity and mortality is higher. It is obvious that breast-feeding confers protection not only by avoidance of contaminated water and food, but also by the activity of a number of host defense factors in the human milk.

Human milk, like other exocrine secretions, has been found to contain large amounts of the specialized secretory IgA antibodies which are an important part of our defense provided by the mucosal lining. Recent studies have shown that exposure, in the mother's intestine to microbial and food antigens, results in a secretory IgA response, which is transferred to the mammary gland. The mother's milk, therefore, contains antibodies against those microorganisms to which the baby is most likely to be exposed. The level of secretory IgA in the milk is remarkably high, providing the infant with 1/4 to 1/2 gram of antibody per day.

Secretory IgA is particularly important in protecting against intestinal infection because, unlike other types of antibody, it is not readily degraded by enzymes in the intestinal tract. It is not the only protective component in human milk, but it is the most important as the newborn can not synthesize its own secretory IgA; in fact, this antibody is the most delayed immune response of the neonate. Milk antibodies cooperate with the iron binding milk protein lactoferrin to hamper the growth of bacteria. The other components in the milk such as lysozyme, bifidus factors, B_{12} binding protein and lactoperoxidase also support the host defense.

In addition to the natural production of secretory IgA in human milk, studies in developing countries have shown that vaccination can increase the level of secretory IgA. In Pakistani women naturally exposed to cholera and with secretory IgA present in their milk against the organism, parenteral vaccination increased the antibody level dramatically. This phenomenon seems present only when the mother is exposed naturally to the organism. Thus, secretory IgA production was not induced in Swedish women who had received parenteral vaccination and had not been exposed to the cholera organism. These studies show that it may be possible to boost the baby's secretory IgA immunity by vaccination prior to weaning.

Boosting the level of immunity in breast milk is not simple. Researchers have given live oral polio vaccine to the Pakistani mothers who had received the cholera vaccine, and found that the level of polio antibodies present in the milk before vaccination practically disappeared. The cholera vaccine seemed to play a role in this response. (The level of polio antibody also diminished significantly in 6 of 10 women who did not receive the cholera vaccine.) The most dangerous period of an infant's life is after weaning when he loses the protection of breast milk.

Breast feeding during weaning is also very important, as the mother produces secretory IgA in the breast milk against any antigen that enters her intestinal tract, including food proteins, and therefore can help protect the infant from developing food allergies. For example, antibodies against cow's milk proteins are found in the breast milk of mothers who drink cow's milk. These breast milk antibodies against food proteins diminish the baby's exposure to the proteins thereby giving him/her the chance to develop a tolerance for them. Continued breast-feeding during weaning reduces the risk of food allergies in infants who are prone to developing them.

After weaning is completed, the best way to protect the infant from infection is by diminishing his exposure to infectious agents. In Costa Rica where a nutrition program has been instituted to go hand in hand with measures to prevent infectious disease, infant mortality and diarrheal disease have decreased 98 percent over the past 12 years.

Dr. Hanson concluded that it is of utmost importance that infants in developing countries are breast-fed to diminish the number of infections and to improve their nutritional status. Also, the data indicate that breast-fed infants in developed countries seem to have fewer infections than formula fed. After weaning it is of great importance to provide not only adequate nutrients, but also public health measures which diminish exposure to infectious agents and improve immunity against them.

5) "Total Parenteral Nutrition in the Management of the Cancer Patient" was presented by Dr. Murray Brennan, Chief, Section of Surgical Metabolism, Surgery Branch, NCI, on May 22, 1980. The summary of his presentation is given below:

Total parenteral nutrition (TPN) is a lifesaving nutritional support modality for patients who are unable to ingest, digest, or absorb sufficient

nutrients to prevent death from starvation. The enthusiastic application of TPN to patients dying of starvation has been extended to claims for the need of nutritional support as a primary therapy for organ failure including renal, cardiac, and gastrointestinal or a support modality during therapy for a multitude of diseases. Current studies suggest that total parenteral nutrition can be lifesaving in the nutritional rehabilitation of the oncological patient, but any effect on prolonging patient survival remains dependent on the adequacy of the anti-neoplastic therapy. A controversy exists between proponents of blind nutritional support of the cancer patient and the scientific evaluation of the efficacy of such support.

The causes of nutritional debilitation or cachexia in the cancer patient include anorexia attributed to taste and smell abnormalities, the increased nutrient demands of an actively growing tumor or as a consequence of therapy, and the remote nutritional effects of the tumor on the host tissue. The cancer patient presents a particular challenge as abnormalities due to associated starvation must be differentiated from abnormalities due to cancer bearing per se. A compounding problem is distinguishing the abnormalities due to cancer bearing from the stress and injury associated with the various types of cancer therapy such as surgery, radiation, and chemo-immunotherapy. Metabolically, in the stress of acute injury or in tumor bearing, the tumor bearing host seems to undergo a rapid mobilization of body resources to meet the need of the tumor. In terms of nutrient consumption, the tumor is an obligate glucose consumer that depends upon the host to recycle the lactate produced by anaerobic glycolysis. This results in a wasteful energy cycle with a double burden to the host; it has to provide the glucose and also recycle the lactate to glucose at an energy cost of 6 ATPs per mole.

Some of the clinical and biochemical parameters that have been employed to support the use of and the need for TPN include: decreases in the serum albumin, abnormalities of anthropometric indices, diminution in acute phase reactants such as transferrin, plasma vitamin and mineral deficiencies, decreased creatinine-height ratio, and demonstrated immuno-competence. The value of these determinations in individual patients, however, has been questionned.

The numerous intravenous mixtures and additives now available provide calories and an amine source, preferably of the synthetic type so as to avoid amino nitrogen loss. In the United States, glucose is the preferred energy source with intravenous fat being employed only to prevent essential fatty acid deficiency. The trace minerals, zinc, copper, selenium, and chromium are used to prevent abnormalities associated with trace metal deficiency. Various vitamin supplement preparations are available and others are currently undergoing investigation as vitamin deficiency syndromes are common in vitamin free total parenteral nutrition.

The evaluation of the efficacy of TPN in the cancer patient can be determined by its impact on <u>reversing</u> known metabolic defects of starvation or disease, and from demonstrations of impact on disease outcome. All cancer patients on TPN, especially those receiving aggressive anti-neoplastic therapy, unfortunately do not gain weight or maintain positive

nitrogen balance, serum albumin often does not increase, and the formation of glucose from alanine may be nearly totally suppressed. Subcutaneous fat stores are readily restored in a manner similar to that seen in the nutritional support of non-cancer bearing controls. Whether nutritional support alone is able to reverse defects in anergy associated with neoplasia, and not uncomplicated malnutrition, is a topic of debate. Complicating the issue is the fact that data in man are lacking on the possibility that nutritional support stimulates tumor growth without meaningful benefit to the host.

Numerous attempts have been made to demonstrate either increased tolerance to therapy or increased response to therapy. However, in studies examining the tolerance to chemotherapy, no improvement has been demonstrated in the percent of the needed chemotherapeutic dose in the group receiving TPN. To date, no difference in patient tolerance to therapy, be it surgery, combined chemo-immunotherapy, radiotherapy, etc., and no improvement in response rate have been demonstrated in those patients receiving TPN.

In the absence of patient improvement with anti-neoplastic therapy given along with TPN, "routinely" providing nutritional support by the intravenous route to patients undergoing aggressive cancer therapy appears unjustifiable. Conversely, in those situations of high response rates and high nutritional morbidity, total parenteral nutrition can now be recommended as a means of nutritionally supporting the patient until the host is able to recover from the nutritional side effects of anti-neoplastic therapy.

Dr. Brennan concluded that the application of therapies designed to direct nutritional support at the peculiar requirements of the cancer bearing host has not been successfully used in man, and studies in animals are conflicting. The availability of TPN has provided a means of total control of all exogenous nutrients, and should be used to explore alternative therapies in oncologic medicine. For the present, TPN is a tool in the management of the cancer patient, not a weapon for anti-cancer warfare.

6) "Chemoprevention of Cancer With Retinoids" was presented by Dr. Michael Sporn, Chief of the Laboratory of Chemoprevention, NCI, at the June 26, 1980 NCC meeting. The summary of his presentation is given below:

A new approach to the prevention of cancer has been developed using retinoids to arrest or reverse the progression of premalignant cells, and thus to delay or prevent the development of invasive malignancy. The basic approach enhances intrinsic physiological mechanisms that protect the organism against mutant clones of new cells that can invade and destroy the organism.

It is known that cancer is a loss of cellular differentiation, and retinoids induce or enhance cellular differentiation thereby representing a physiological rather than a cytotoxic approach to arrest or reverse carcinogenesis. The most important conceptual advance is that retinyl acetate, retinol and retinal are the retinoids that can act directly on cells in culture to suppress the malignant transformation induced by either chemicals or

radiation. The mechanism of action of the retinoids in blocking transformation is unknown at present. However, some recent studies show that retinoids block phenotypic cell transformation produced by sarcoma growth factor (SFG), although the molecular interaction between the retinoids and SFG is still not understood.

In addition, major progress has been made in the suppression of tumor promotion by retinoids, particularly in their ability to antagonize the promoting effect of phorbol esters. Although the manner in which retinoids modify the properties of malignant cells that are fully transformed needs clarification, certain situations do exist where retinoids modify the growth of malignant transformed cells. Retinoic acid is able to restore anchorage dependent growth to a transformed rat fibroblast cell line and to a murine melanoma cell line. Several transformed cell types still retain regulatory mechanisms that are responsive to retinoids. Further investigation is needed to determine whether retinoids may eventually be used to treat fully invasive malignancies, as well as to determine why most malignant cell types do not respond to treatment with retinoids.

Future usefulness of retinoids in cancer prevention depends on the availability of more potent or less toxic synthetic derivatives with better pharmacokinetic properties, particularly with respect to reaching desired target tissues in high concentrations, without undesirable sequestration and accumulation in liver. New molecules with major modifications of either the ring, side chain, or polar terminal group of the basic retinoid structure, have been found to have significant biological activity. A few examples are the aryl triene analog of retinoic acid (the carbon atoms 11-14 of the conjugated side chain have been replaced by an orthogonal benzene ring); 4-hydroxyphenyl retinamide, one of the amide derivatives of retinoic acid with a modified polar terminal group; and a new series of analogues, the retinylidene 1,3-diketones, a derivative of the terminal aldehyde group of retinal. A synthetic retinoid does not need any functional group to have biological activity, as shown by axerophthene (vitamin A hydrocarbon) which has activity very similar to that of retinal or retinyl acetate.

The toxic properties of retinoids and ways of overcoming these properties have also been examined. One particularly useful assay involves the release of chondroitin sulfate from cartilage in organ culture. Some of the toxic effects of retinoic acid in vivo have been reported to be prevented by inhibitors of prostaglandin synthesis, such as aspirin or several of the nonsteroidal antiflammatory agents. In addition, targeting retinoids to particular organ sites can lessen their toxic effects. For example, targeting 4-hydroxyphenyl retinamide to suppress carcinogenesis in the breast lessens its toxic effect on the liver.

Now that biologically active synthetic retinoids have become more available, testing these compounds in long term animal tests for their role in preventing carcinogenesis has increased. Most of the experimental designs have involved testing the retinoids as "anti-promoting" agents. Studies, particularly those concerned with bladder cancer, involve looking at the effect of retinoids in blocking further promotion or progression of carcinogenesis

during the latency period when cells are still in a preneoplastic state and before invasive malignancy is histologically detectable. Cis-retinoic acid has undergone the most extensive testing for assessing the ability of retinoids to arrest tumor promotion and progression.

Also, recent studies indicate that retinoid deficiency increases the risk of developing cancer. For example, a vitamin A deficiency in rats has been shown to markedly enhance the susceptibility of the lung and bladder to chemical carcinogenesis. By implication, these data indicate the important use of synthetic retinoids for obtaining increased levels of serum and tissue vitamin A for the prevention of carcinogenesis at specific organ sites.

Retinoids are potent inhibitors of both the process of malignant transformation and the process of tumor promotion. The oncogene theory of carcinogenesis is that the oncogene is responsible for transforming a normal cell into a tumor cell, presumably because it has the genetic information for making the transforming protein(s) (whose) genes ordinarily are not expressed because of repressors of oncogenic activity. Agents such as radiation or chemical carcinogenesis (and even normal aging) exert their oncogenic action directly on the oncogene present in all cells, and cancer results from the destruction of the normal repressor systems that keep the oncogenic and virogenic information in check in the normal adult cell.

All exogenous agents are either inducers or enhancers of the activity of the ultimate endogenous carcinogens. The activity of these exogenous agents would be defined in terms of their ability to facilitate the synthesis or action of specific transforming proteins. Those that are known to damage the DNA and are highly mutagenic may be postulated to have the ability to inactivate the genes that normally repress the synthesis of transforming proteins and thus to activate synthesis of transforming proteins in an irreversible manner.

In view of the conceptual and operational difficulties in separating carcinogenesis into "pure initiation" and "pure promotion" it is simpler to think of the transforming proteins, derived from the oncogene, as the ultimate endogenous carcinogens and to consider all other initiating or promoting agents in terms of their ability to facilitate the synthesis or activity of these transforming proteins. Redefinition of the process of carcinogenesis provides a hopeful outlook on prevention. A variety of agents called carcinogens or promoters all converge on a common oncogene product, a transforming protein, as their final pathway.

Dr. Sporn concluded that the data at hand indicate that whether the inducing or promoting factors are as diverse as polycyclic hydrocarbons, ionizing radiation or phorbol esters, or whether the ultimate carcinogen, a transforming protein itself, is used, retinoids have the ability to suppress the expression of the malignant phenotype. Phenotypic suppression is not the ultimately desirable way to prevent cancer, however the retinoids offer a practical approach to prevention by extending the latency period. Until one can successfully repress the oncogene, prevention by phenotypic

suppression is necessary and the use of retinoids offers a practical approach to this goal.

7) "Nutrition in the Multiple Risk Factor Intervention Trial (MRFIT)" was presented by Ms. Jeanne Tillotson and Ms. Marilyn Farrand, nutritionists, Preventive Cardiology Branch, Division of Heart and Vascular Diseases, NHLBI, at the July 24, 1980 NCC meeting. A summary of their presentation is given below:

One aim of dietary intervention in nutrition programs for disease prevention, particularly coronary heart disease (CHD), is to involve individuals in the assessment and potentially in the management of changes in food practices. One intervention study is the Multiple Risk Factor Intervention Trial (MRFIT), a clinical trial of major importance for the prevention of CHD, that has as its main objective to ascertain whether a special intervention program for changing risk factors in men at increased risk of death from CHD can result in a significant reduction in mortality from this disease.

Twenty-two clinical centers participate in the trial with data coordinating activities based in Minneapolis, Minesota. Beginning in 1973, 12,866 men between the ages of 35 to 57 were accepted into the trial based on the presence of one or more of the major risk factors associated with CHD. (The three major risk factors are elevated serum cholesterol, elevated diastolic blood pressure, cigarette smoking.) The men were determined to be clinically free of CHD and sufficiently motivated to participate in a six year program, and were then randomly assigned to either a special intervention or usual care group.

The typical MRFIT participant at entry was 47 years old and weighed 189 pounds, more than half were 20 percent above their ideal weight, and 60 percent were smokers. An important aspect of the program is that individual attention is given to tailor the program to each participant's needs. Lifestyle, home and work environment, and personal relationships are considered and family members are encouraged to become involved, especially in the selection and preparation of foods. The primary goal of the nutrition component is to lower blood cholesterol and the objectives are fourfold: to provide participants with an understanding that changing food patterns is vital; to motivate the participants to adopt changes in food habits; to provide information needed for dietary change; and to help apply this knowledge to daily living. Individual and group counseling are the major approaches used for nutrition education and for smoking cessation; hypertension therapy is by medication supplemented by dietary measures.

Evaluation of the quality of dietary patterns, related specifically to dietary fat and cholesterol, forms an integral part of the intervention on hyperlipidemia. Participants in the trial are taught how to modify the fat and cholesterol content of their diets, and also how to assess their compliance with the dietary advice.

One of the nutrition teaching aids used in counseling participants in the intervention group is a "food scoring system." It allows both the nutritionist and participant to assess how substantially the diet has been modified in terms of reaching the recommended reduction in the fat and cholesterol content. The scoring system is based on the effect of each food on raising or lowering blood cholesterol levels. This effect on blood lipids, expressed as the quantity, "B", is based on the dietary saturated fat, polyunsaturated fat, and cholesterol composition. The "B" value of any food is expressed by the formula: $B=0.475 (SFA - 0.5 PFA) + 0.02 chol$, where SFA and PFA represent saturated fat and polyunsaturated fat as grams per food portion and chol represents cholesterol in milligrams per food portion.

A positive score for a food indicates that the food has an excess of saturated fat and/or cholesterol over polyunsaturated fat. The converse is true for foods with negative values. The higher the positive value among a representative group of foods, the less favorable is its selection. The lower the positive value the more favorable.

The effectiveness of the participants' effort to modify food intake behavior depends, in part, on their ability to recognize foods with high scores and to substitute them for foods with lower scores. An obvious consequence of food scoring is that this analysis provides feedback of vital information on present dietary behavior. Participants score their diet, are allowed to make substitutions, and then are able to see the impact of various foods of a specific dietary regime on their total daily food score.

Another method for assessing dietary adherence is the so-called Food Record Rating (FRR) that appears useful for monitoring and teaching individual participants periodically during the year. The FRR uses the MRFIT food score concept as an aid in reviewing and increasing the participants' understanding of appropriate food selection in terms of fat contribution; it enables both the counselor and the participant to relate reported food intake directly to the MRFIT eating pattern goal; and it helps the participant, with the aid of the nutrition counselor, to plan and monitor dietary changes preferentially made in adapting to a new style. This method is applicable in public health programs addressing the need for nutrition education for dietary intervention on hypercholesterolemia.

Ms. Farrand and Ms. Tillotson concluded that although MRFIT has another year (ends 1982) before final data analysis, preliminary findings suggest that intervention does reduce risk factors. This clinical trial provides an excellent opportunity for nutritionists to work closely with physicians, behavioral scientists, nurses and other scientists in a program to change food habits, reduce elevated blood pressure and achieve cessation of smoking.

8) "Biochemical Toxicology of Ingested Toxins" was presented by Dr. Carol M. Schiller, Head of the Gastrointestinal Function and Toxicology, NIEHS, at the September 18, 1980 NCC meeting. A summary of her presentation is given below:

Environmental toxicity is being explored through a renewed interest in how man's intestine functions and how exposure, through inhalation and skin contact, affects the organ. The research of the Gastrointestinal Function and Toxicology Work Group of NIEHS focuses on the effects of ingested toxins on gastrointestinal function. The possible human exposure to a large number of chemicals through ingestion of inadvertently contaminated food and water, and the role of the organ specificity of the digestive tract to these various toxic effects are important factors in the development of continuing research projects. Areas of particular interest are in the field of intestinal absorptive cells, the intestine as a gluconeogenic organ, the regulation of intestinal detoxication processes, and organ specificity of colon carcinogens and toxins. The mechanics of these processes are being examined at the cellular, subcellular, and molecular levels.

In studies of the intestine as a gluconeogenic organ, metabolism in intestinal cells appears anaerobic to some degree as opposed to the more general aerobic metabolism in most cells of the body. This anaerobic metabolism is similar to that in tumor cells, and therefore the intestine may be a significant target organ for carcinogenicity. An important finding is that the major energy source used by the intestine for metabolic and absorptive functions is glutamine rather than glucose.

Work with acrylamide, a known neurotoxin, has suggested an approach to looking at a broad range of toxins that might act on the intestine as a target organ. The activity of key enzymes has been altered in some animals with acrylamide intoxication. For example, high levels of sciatic nerve B-glucuronidase have been correlated with the onset of neurological deficit brought on by acrylamide. Acrylamide has been shown to interfere with general metabolism resulting in a loss of body weight, decreased food consumption, and increased water consumption. These digestive alterations and resulting malabsorption of nutrients might be due to the binding of acrylamide to proteins in the digestive tract which leads to abnormalities in the catalyzing capabilities of enzymes.

It has been demonstrated that the effect of acrylamide on the performance of certain behaviors is "diet" dependent in that animals fed a purified diet and given equal doses of acrylamide have poorer motor coordination and development, based on the inclined screen test, than those animals fed a regular cereal diet. These animals also have a greater sensitivity to lethal doses of acrylamide than those fed a regular cereal diet. This result has led to further studies on the absorption of toxins and suspected toxins in "normal" intestinal tissue in order to better understand their impact on the body and their possible role in altering the absorption of nutrients.

The results of one study conducted to elucidate the effects of prenatal and lactational exposure to acrylamide on the ontogeny of key enzymes involved in intestinal metabolism indicate that prenatal and lactational exposure to acrylamide does significantly change intestinal enzyme levels, i.e. increases or decreases, during the early stages of development. Acrylamide or a metabolite of acrylamide appears to be present in the milk of dams treated with acrylamide. Further research is necessary to determine if

these changes are reflected in subsequent alterations in the structure or function of the intestine.

Another study completed last year revealed that the chemical 1,2 dimethyl-hydrazine (DMH), that is structurally similar to a component of jet aircraft fuel, produced colon cancer in a single low oral dose in 80 percent of the exposed animals in the experiment. This effort was observed 1 1/2 years after exposure, which in terms of comparable life span is a person of retirement age. In other studies, a single dose of DMH to pregnant animals changed significantly the normal pattern of intestinal brush border and plasma membrane enzyme development, and therefore, enzymatic activity in the intestine of offspring. Prenatal exposure to the chemical induced tumors in the brain and jejunum.

Dr. Schiller concluded that the intestine comes into contact with all of the food and water people ingest and 20 percent of what is inhaled is actively swallowed; environmental agents in the air therefore come under direct intestinal exposure. Many areas of research on the role of the intestine in the metabolism of nutrients, toxins, and other environmental agents remain to be elucidated.

THE "NIH-NCC GROCERY GROUP"

In FY 1979 the NCC and the NCC Office helped in coordinating the nutrition activities held as part of the DHHS sponsored health fair, entitled "HEalth-Works' 79." One of these nutrition activities with tremendous appeal was the performances of the "NIH-NCC Grocery Group," a sing-along with actors giving sound nutritional advice. The lyrics developed for "The Grocery Group" incorporate nutrition principles for good eating practices at breakfast, lunch and dinner and emphasize "moderation" and "variety" as the theme.

The written lyrics for the "NIH-NCC Grocery Group" and some limited technical assistance are available through the NCC Office for use by any group interested in putting on the performance. This educational and entertaining show is being staged by local talent at various grade schools, community colleges, state and local health departments, and private organizations across the country.

DHHS/USDA PUBLICATION: NUTRITION AND YOUR HEALTH, DIETARY GUIDELINES FOR AMERICANS

In FY 1979, USDA and DHHS established a joint task force to develop dietary guidelines for the public. The NCC Office, with comments from some of the NCC members, played a major role in contributing to the drafts of the guidelines so that a statement based upon the scientific state-of-the-art of nutrition could be made available to the public. The joint DHHS-USDA publication was issued March 1980. Copies of the guidelines are available to consumers from the Consumer Information Center, Pueblo, Colorado (#656-H).

VIDEOTAPE SERIES, "EAT WELL, BE WELL"

The NCC was asked to serve as consultants to the production of a series of videotapes entitled "Eat Well, Be Well" that was to be produced by Amram Nowak Associates and funded by Metropolitan Life Insurance Company.

The "Eat Well, Be Well" series of 26 four and one-quarter minute videotapes and 1 thirty minute anthology, expresses up-to-date nutritional messages illustrated by recipe and menu suggestions. Each videotape presents in a practical and visually pleasing manner the scientific state-of-the-art and rationale behind the many aspects of the DHHS/USDA joint publication, Nutrition and Your Health, Dietary Guidelines for Americans.

The following recipes for salads, main dishes, desserts and snacks are featured in the videotapes and are available upon request from the Metropolitan Life Insurance Company: Crunchy Apple Cobbler, Crispy Baked Chicken, Hot Fruit Medley, New French Toast, Broc in a Wok, Fish In Wine and Yogurt Sauce, Hot Mulled Wine, Refrigerator Rice Salad, Stir Fried Chicken, Oatmeal Scones, Low-Fat White Sauce with Horseradish and Mustard, Low-Fat Wine and Cheese Sauce, Strawberry Yogurt Pops, Cheese Tostados With Refried Beans, Tuna Quiche, Pasta Primavera, Slim Green Goddess Salad Dressing, Buttermilk Herb Salad Dressing, Ribollito Soup, Turkey Curry, Scalloped Potato Casserole, Lemon Bavarian Creme, Nouvelle Beef Stroganoff, Rice Con Queso, and Irish Soda Bread. Each of the recipes reflects the economic as well as the nutritional aspects of providing appetizing dishes.

Plans for distributing and promoting the "Eat Well, Be Well" series include transmitting it via satellite to the 225 P.B.S. television stations across the country in the spring of 1981 for showing it in the fall of 1981, and making it available to the USDA Home Extension Service, the Society for Nutrition Education, and other interested agencies or organizations. This series is an excellent example of joint industry and government cooperation in a nutrition education endeavor, and hopefully will encourage the development of similar projects to enhance the public's knowledge about nutrition and health.

CONFERENCES SPONSORED BY THE NCC

The NCC mandate calls upon the NCC to sponsor conferences, workshops, and symposia in areas of nutrition research that are of concern to the Institutes.

The Conference on the Assessment of Nutritional Status originally planned for FY 1980 was postponed until September 16-18, 1981. This conference will be cosponsored by the NIH-NCC, the Food and Drug Administration and the Centers for Disease Control, and held at the NIH. The purpose of the conference is to review the state-of-the-art and current research on nutritional status in order to better define the most appropriate methods of assessing the dietary intake and nutritional status of hospitalized patients and normal populations through surveys. The following six sessions are planned for the conference: Assessment of Nutritional Status of

the Individual, New Approaches to Methods for the Assessment of Nutritional Status of the Individual, Effects of Nutritional Status on Functional States, the Assessment of Nutritional Status in Epidemiologic Studies and Surveys of Populations, Recent Advances in Food Consumption Methodology, and Summary and Recommendations.

DHHS HEALTH RESEARCH PLANS AND INITIATIVES...THE NUTRITION RESEARCH INITIATIVE

In April 1978, the Secretary of the Department of Health, Education and Welfare, Mr. Joseph A. Califano, initiated a major review and reappraisal of the Department's health research activities and long-term interagency research proposals. Each agency in the Department thereby identified their health planning activities and the significance of research within their specific mission statements.

In order to coordinate research planning and implementation, and thereby strengthen research, a steering committee consisting of representatives from the various agencies was established to define a number of health research initiatives. The initiatives were to focus on selected problem areas where mission needs of several DHEW agencies coincide with significant scientific opportunity. The health research principles approved by the Department in August 1979 were to serve as a basis in developing each initiative.

The NIH was designated as the sponsoring agency to develop the Nutrition Research Initiative, and the NCC Chairman was designated as coordinator. The agencies designated as cosponsors of the initiative were: The NIH-NCC; ADAMHA; FDA; CDC; the Office of Health Research Statistics and Technology, NCHS-Hanes; and the Bureau of Health Manpower, HRA. The impetus to develop this initiative in nutrition stemmed from the rapidly growing scientific interest, lively public debate on the pertinence of nutrition to particular health problems, and evolving Federal efforts to coordinate nutrition research at both policy and program levels.

The purpose of the nutrition initiative is to develop within the DHHS a more comprehensive and effective program of nutrition research and training to strengthen support of related missions. The principle thrust is to reinforce a coherent research program and to extend the growing trans-Institute cooperation in nutrition research to other agencies.

In order to carry out the nutrition initiative and develop a cohesive program for the Department, it will be necessary to structure a committee with members (one or more as appropriate) from the agencies that conduct or support nutrition research and training. This Committee on the Biomedical and Behavioral Aspects of Nutrition Research and Training will have the following responsibilities:

- Review and comment on the plans, execution, and results of research efforts, in order to refine and strengthen the Department's nutrition program;

- o Coordinate research stemming from the obesity program, the CNRU's, nutrition research training and manpower development programs, and participation in OSTP's JSHNR;

- o Provide information and advice on the nutrition research program to the directors of the agencies involved, to the Office of the Assistant Secretary for Health, and to the Office of the Secretary;

- o Continuously evaluate research data and provide advice for the development of nutrition education materials for the public; and

- o Plan and arrange for conferences, workshops, consensus development exercises, and reports as appropriate.

The DHHS Nutrition Research Initiative is included in this report as Appendix E.

III.

NUTRITION COORDINATING COMMITTEE OFFICE

The Nutrition Coordinating Committee Office staff represents the NIH on a number of nutrition-related committees involving other Federal agencies and departments, and the executive branch, and is primarily responsible for responding to information requests about nutrition in general and about the NIH nutrition program in particular.

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ACTIVITIES OF THE NCC OFFICE

As in past years, in addition to staffing the NCC and its two Subcommittees, the NCC Office responded to a great number and variety of requests for information on nutrition and the NIH nutrition program from the Congress, other Federal agencies, the scientific community, and the public. The major responsibilities of the NCC Office were: to compile and analyze the data on the NIH nutrition program in order to develop the Annual Report of the NIH Program in Biomedical and Behavioral Nutrition Research and Training; to collect and analyze data in preparing testimony and "special presentations" for the Office of the Director, NIH, and the Office of the Assistant Secretary for Health; to present the NIH nutrition program at national conferences and at meetings of professional societies; to assist the NIH Information Office with the preparation of press releases; and to provide input into DHHS nutrition activities.

The NCC Chairman represented the NIH at the DHHS Nutrition Coordinating Committee and at the USDA-DHHS Informal Coordinating Committee's quarterly meetings. Furthermore, the NCC Chairman cochairs and also serves as the Executive Secretary for the Joint Subcommittee on Human Nutrition Research (JSHNR) of the Office of Science and Technology Policy. The JSHNR first met in FY 1979 as evidence of the increased interest in nutrition research in the Executive Office of the President, the White House. On December 5, 1980, the JSHNR issued the first of a series of reports entitled Federally-Supported Human Nutrition Research, Training and Education: Update for the 1980s. I. Human Nutrition Research and Training. The report was also published as a supplement in the May 1981 issue of the American Journal of Clinical Nutrition.

CONGRESSIONAL HEARINGS, REPORTS, AND SPECIAL PRESENTATIONS ON NUTRITION

The NCC Office has responded to information requests on nutrition, nutrition research, and the NIH Program in Biomedical and Behavioral Nutrition Research and Training from a broad spectrum of sources: the Congress, the Office of Technology Assessment, and the General Accounting Office; the Executive Branch, including the Office of Science and Technology Policy, the Office of Management and Budget, and various agencies of the Public Health Service; as well as from the scientific community and the public. The central focus provided by the Office has undoubtedly facilitated NIH responses.

In order to expeditiously develop reports on each Institute's nutrition program and on the overall NIH Program in Biomedical and Behavioral Nutrition Research and Training, the NCC Office developed a computerized system for data retrieval on all nutrition research and training activities in the extramural and intramural programs at the NIH. This computerized data retrieval system is described on page 3.

FY 1980 Congressional Hearings

In FY 1980, the NCC Office staff provided input to the following hearings:

The hearing on "Diet and Cancer Research at the NCI, Clinical Nutrition Research at NIH, and Problems with the Peer Review System at NIH" held on October 2, 1979 before the Subcommittee on Nutrition of the Senate Committee on Agriculture, Nutrition and Forestry, addressed two principal issues, the NCI nutrition program and the NIH peer review system. The Director, NCI, testified on the former issue while the Director, NIH, testified on the latter. The Director, NIH, discussed also the NIH nutrition program, emphasizing the Clinical Nutrition Research Units (CNRU's). A report from this hearing, entitled "Diet and Cancer Relationship" is available from the U.S. Government Printing Office (#56-151).

The hearing on "Current Status Impediments and Potential Solutions: Nutrition Training for Health Professionals," held on November 8, 1979 before the Subcommittee on Nutrition of the Senate Committee on Agriculture, Nutrition and Forestry, stressed three points: 1) the need to have nutrition as more than just an elective in medical school programs; 2) the need for public awareness in this area in order to assert political pressure; and 3) the need for physicians to teach nutrition and thereby possibly increase the importance of the field of nutrition. The Health Resources Administration (HRA) provided testimony at the hearing. A report from this hearing entitled "Nutrition Training of Health Professionals" is available from the U.S. Government Printing Office (#54-832).

The hearing on "Marketing and Promotion of Infant Formula in Developing Countries" was held on January 30, and February 11, 1980 before the Subcommittee on International Economic Policy and Trade of the House Committee on Foreign Affairs. The specific focus of this oversight hearing was to review the results of the October 1979 WHO/UNICEF Joint Meeting on Infant and Young Child Feeding and to determine how much has been accomplished towards establishing a code for the marketing of infant formula. The NCC Chairman testified on the accomplishments of the October 1979 Joint WHO/UNICEF meeting acknowledging that problems in regulating the promotion of breast-feeding and products used as breast milk substitutes were recognized to require handling at the international level.

The hearing on "Diet and Health" was held on February 20, 1980 before the Subcommittee on Health and Scientific Research of the Senate Committee on Labor and Human Resources. In his testimony, the DHEW Assistant Secretary for Health and Surgeon General, stressed the need for more conclusive evidence in several diet/health areas noting that great strides have been made in the past three years in developing a consensus of scientific views.

The hearing on "The National Academy of Sciences (NAS) Food and Nutrition Board (FNB) and Its Report, Towards Healthful Diets" was held June 18-19, 1980 before the Subcommittee on Domestic Marketing, Consumer Relations, and Nutrition of the House Committee on Agriculture. The primary issue underlying the hearing was the discrepancy between the NAS report and

the recommendations of the DHHS/USDA publication, Nutrition and Your Health, Dietary Guidelines for Americans, on the issue of saturated fat and cholesterol. The Director, NHLBI, and the Deputy Assistant Secretary for Health, DHHS, testified on behalf of the Department.

The hearing on "USDA Feeding Programs and the USDA/DHHS Dietary Guidelines" held on July 16, 1980 before the Senate Appropriations Subcommittee on Agriculture and Related Agencies, addressed the following issues: the question concerning the scientific validity of the USDA/DHHS dietary guidelines on the consumption of fat, saturated fat and cholesterol; the appropriateness of joint USDA/DHHS guidelines on matters of public health; and the role of the Federal Government in promoting or discouraging changes in behavior, lifestyle and diet. The debate centered on the differences in recommendations from the USDA/DHHS and the National Academy of Sciences regarding the third guideline on fat and cholesterol consumption. The Director, NHLBI, and the Deputy Assistant Secretary for Health, DHHS, testified on behalf of the Department.

Official Reports

The NCC Office has provided input for reports prepared by other Federal agencies, as well as the General Accounting Office. In FY 1980, the Office supplied data used in the preparation of the following five documents:

"Greater Federal Efforts Are Needed to Improve Nutrition Education for U.S. Medical Schools," developed by the General Accounting Office, reported on the current status of nutrition education programs in medical schools and made a number of recommendations on how the Federal Government might take the initiative to try to strengthen the nutrition curriculum.

"USDA-WIC Rule on Eligibility Criteria for Special Supplemental Food Program for Women, Infants and Children (WIC)," prepared by the Food and Nutrition Service, USDA, proposes income eligibility standards along with nutritional risk criteria for determining eligibility of persons participating in the WIC Program.

"Federal Food, Agriculture, and Nutrition Programs (FANI)," developed by the General Accounting Office in cooperation with the USDA and the Office of Management and Budget, is an inventory report of 359 Federal programs in 28 different departments and agencies.

"The DHHS Nutrition Information and Education Inventory," compiled by the DHHS-NCC Subcommittee on Nutrition Education, lists DHHS activities in the following three areas: nutrition education and information provided to the public; training programs for health professionals in the field of nutrition; and research in nutrition education.

"The Justification of Appropriation Estimates for Committee on

Appropriations" (Moyer material on the NIH Nutrition Program), prepared by the NCC Office and the NIH Office of Communications at the request of the Labor-DHHS Appropriations Subcommittee of the House of Representatives, includes the financial obligations in nutrition of the PHS (NIH, FDA, CDC, HRA) and the Office of Human Development, Administration on Aging, along with a description of each agency's nutrition program.

Special Presentations, Seminars And Sessions

Throughout the year, the NCC Chairman and Office staff presented the NIH nutrition program and special presentations on nutrition at the invitation of professional societies and other groups.

The NCC Chairman:

° ...spoke before the Women's City Club of Cleveland luncheon lecture program on "Current Research and Thinking on How Food and Vitamins Affect The Aging Process," held in Cleveland, Ohio on October 22-23, 1979;

° ...participated as a member of the panel on "Nutrition Programs at the Federal Level" sponsored by the American Dietetic Association, American Home Economics Association, Institute of Food Technologists, Society for Nutrition Education, and the Washington, D.C. Nutrition Group, held in Crystal City, Virginia, on November 8, 1979;

° ...spoke before a group of graduate students at the National Nutrition Consortium's Washington Seminar on Nutrition Policy, entitled "NIH/DHHS Research and its Applications" held at NIH, in Bethesda, Maryland, on January 15, 1980;

° ...participated as a member of the panel on "The Nestle Boycott - What are The Special Responsibilities of Corporations?" to discuss issues resulting from the WHO/UNICEF meeting held in Geneva, October 9-12, 1979. The panel was held at the University of Virginia Medical School, Charlottesville, Virginia, on January 23-24, 1980;

° ...was the keynote speaker at the George Washington University School of Medicine Annual Student Research Day on "The Biomedical and Behavioral Basis of Clinical Nutrition" held at George Washington University, Washington, DC, on February 12, 1980;

° ...spoke at the Food and Nutrition Forums Program: Feeding People, Your Link in a Common Goal on "Nutrition and Your Health," sponsored by the National Nutrition Consortium with the Nutrition Section of the Institute of Food Technologists, the Florida Dietetic Association, Gainesville District Dietetic Association, Kansas Nutrition Council, and the Southern California Section, Institute of Food Technologists Greater Los Angeles Nutrition Council. The Forums were held in Florida, Kansas, and California, March 23-28, 1980.

Other NCC staff spoke at the Denver Regional World Conference on the UN Decade for Women, 1980, on "Different Approaches to Health Care," Denver, Colorado, on March 27, 1980.

The NCC Chairman presented a critique of the seminar report "Maternity Care in Ferment; Conflicting Issues" at the Annual Meeting of the Research Advisory Committee of the Maternity Center Association, held in New York, on April 10, 1980.

The American Institute of Nutrition Symposium entitled "Nutrition Initiatives in the Federal Government," was part of the 64th Annual Meeting of the Federation of American Societies for Experimental Biology, held in Anaheim, California, on April 13-15, 1980. Speakers included the NCC Chairman; Dr. K. McNutt, National Nutrition Consortium; Mr. D. Greenberg, editor and publisher, Science and Government Report, and Washington columnist for New England Journal of Medicine and for New Scientist; Dr. D. Hegsted, Administrator, Human Nutrition Center, USDA; Dr. V. Herbert, Chief, Hematology and Nutrition Laboratory, Bronx V.A. Medical Center; Dr. G. Omenn, Associate Director for Human Resources and Social and Economic Services, Office of Science and Technology Policy, Executive Office of the President; and Dr. S. Miller, Director, Bureau of Foods, FDA. The proceedings of the symposium were published by The Institute of Nutrition of The University of North Carolina.

The NCC Chairman participated as a member of the Human Nutrition Working Group for a planning conference entitled "Animal Agriculture - Research to Meet Human Needs in the 21st Century," held in Boyne Falls, Michigan, on May 4-7, 1980. The conference was sponsored by the American Assoc. for the Advancement of Science, the American Dairy Science Assoc., the American Meat Science Assoc., the American Society of Animal Science, the Assoc. of American Veterinary Colleges, the College of Veterinary Medicine, Michigan State University, the Michigan State Agriculture Experiment Station, the Poultry Science Assoc., the U.S. Department of Agriculture, and the Winrock International Livestock Research and Training Center. The keynote speakers were: Philip H. Abelson, Editor, Science Magazine; Carol Tucker Foreman, Assistant Secretary, Food and Consumer Services, USDA; Anson R. Bertrand, Director, Science and Education Administration, USDA; Glenn W. Salisbury, Director Emeritus, Agricultural Experiment Station, University of Illinois; and Sylvan H. Wittwer, Director, Agricultural Experiment Station, Michigan State University. Proceedings of the conference are available from Westview Press, Inc., 5500 Central Avenue, Boulder, Colorado 80301, Frederick A. Praegar, Publisher.

The NCC Chairman spoke on "1977 Food Consumption Survey and HANES Study" at the Food and Nutrition Section/71st Annual Meeting and Exposition of the American Home Economics Association, held in Dallas, Texas, on June 23, 1980.

Other NCC staff presented the "NIH Program in Biomedical and Behavioral Nutrition Research and Training" at the Orientation for Public Health Nutrition Students from the University of North Carolina, held in Rockville, Maryland, on July 16, 1980.

The NCC Chairman:

° ...gave two presentations at the VI Western Hemisphere Nutrition Congress held in Los Angeles, California. The first was an "Overview of Nutritional Status in the U.S.," presented on August 12, 1980, and the second was "National Nutrition Policy in the U.S.," co-authored by Dr. Gilbert S. Omenn, Associate Director, Office of Science and Technology Policy, Executive Office of the President, presented on August 14, 1980;

° ...presented the luncheon address at the 21st Annual Meeting of the American College of Nutrition - Nutrition and Child Health Perspectives for the 1980s - on "The Concept of Clinical Nutrition and the NIH's CNRU Program". The luncheon was held in Bethesda, Maryland, on September 9, 1980; and

° ...presented the opening lecture on "Food and Health Prevention, the Secret of Wholeness" for the Seminar Series on Medicine and Theology held at the Wesley Theological Seminary, American University, Washington, DC, on September 11, 1980.

SCIENCE WRITERS SEMINAR IN NUTRITION

In order to provide the news media with background information on current research areas, the NIH periodically holds Science Writers Seminars. The seminars serve chiefly as tutorials but may occasionally produce "news" or feature articles. The NCC Office and the NIH Division of Public Information organized the Science Writers Seminar on Nutrition Research held on November 9, 1979. The Chairman of the NCC was the moderator. Three NIH scientists presented their studies in human nutrition research. The presentations were: "Vitamin A: Vitamin, Hormone, or Both?" by Dr. Gerald J. Chader, Head, Section on Retinal and Corneal Metabolism, Laboratory of Vision Research, NEI; "Metabolism Studies with Isolated, Intact Small Intestine by Vascular Perfusion" by Dr. Herbert G. Windmueller, Research Chemist, Laboratory of Nutrition and Endocrinology, NIAMDD; and "Mineral Nutrition in the Premature Newborn" by Dr. James W. Hansen, Senior Investigator, Neonatal and Pediatric Medicine Branch, NICHD.

POLITICS OF NUTRITION AND PUBLIC HEALTH

In April, 1979, the NCC Office participated in "The Politics of Nutrition and Public Health" session of the NIH Staff Training Extramural Programs (STEP) Module No. 4 on "The Politics of Health: 1979 Update." The 3-day module was made up of five sessions that emphasized major health-related topics of interest to the Congress and the public. The NCC Chairman assisted the module director, Dr. George J. Cosmides of the National Library of Medicine, in planning the session on "The Politics of Nutrition and Public Health" and the NCC Chairman served as a faculty member and chairperson of the session. The session's panel consisted of Dr. Allan

L. Forbes, Associate Director for Nutrition and Food Sciences, Bureau of Foods, FDA; Mr. Thomas P. Grumbly, Associate Administrator, Food Safety and Quality Service, USDA; Mr. Rodney E. Leonard, Deputy Director, U.S. Office of Consumer Affairs, the White House; Dr. Johanna Dwyer, Director, Frances Stern Nutrition Center, New England Medical Center Hospital; and Mr. Christopher T. Hitt, Professional Staff Member, Subcommittee on Nutrition of the Committee on Agriculture, Nutrition and Forestry, U.S. Senate. The NCC Office published the proceedings of "The Politics of Nutrition and Public Health" in January 1981.

NCC OFFICE--CLINICAL CENTER STUDY ON THE LONG-TERM EFFECT ON INFANTS OF HYPOCHLOREMIC METABOLIC ALKALOSIS RESULTING FROM INFANT FORMULA DEFICIENT IN CHLORIDE

In July 1979, a kidney specialist reported three cases of metabolic alkalosis in infants who were being fed only Neo-Mull-Soy, a soybean based formula deficient in chloride, an essential nutrient. Epidemiological work carried out by CDC found an additional 128 cases of infants who had at least one episode of metabolic alkalosis while being fed either Neo-Mull-Soy or Cho-Free, another soybean based formula deficient in chloride. (Metabolic alkalosis is an accumulation in the body of organic base compounds, such as blood bicarbonate, resulting in the derangement of the normal acid-base balance.) Analysis of formula preparations found that the products contained one-third the chloride stated on the product label and supplied approximately one-fifth the chloride recommended for infants by the American Academy of Pediatrics. The formulas were voluntarily recalled after having been on the market for about 16 months.

The NIH, at the recommendation of the NCC Office, began a pilot study of infants with documented metabolic alkalosis secondary to feedings of formula deficient in chloride. In accordance with NIH policy each child was admitted to the pilot study at the recommendation of his/her physician. The children are admitted to the study either as inpatients or outpatients. The study protocol includes a complete physical, neurological, and psychological examination along with detailed medical, social, and dietary histories. Special tests are selected in order to rule out other causes of metabolic alkalosis, especially Bartter's Syndrome, which has symptoms similar to those observed in these infants.

A few affected infants were studied by their own physicians during the most severe phase of their illness. These infants are admitted as inpatients for two weeks to determine how they respond to a low, but adequate sodium level in their diet. Investigations are carried out to detect possible hormonal changes. None of the diagnostic tests are harmful to the infants and if any abnormalities are found, they will be further evaluated and treated.

Because only about 1 percent of the infants receiving the formulas developed hypochloremic metabolic alkalosis, the study is attempting to identify the factors that enhanced the infants' susceptibility to developing this metabolic alkalosis. Periodic re-evaluations should reveal any long-term

effects on growth and development of the metabolic alkalosis that resulted from ingesting only the chloride deficient formulas.

A team of NIH investigators are conducting the study under the leadership of Dr. Van S. Hubbard of the NIAMDD, Pediatric Metabolism Branch. The four associate investigators are: Dr. James W. Hansen, NICHD, Dr. Charles C. Chang, NINCDS, Dr. Howard A. Moss, NIMH, and Dr. Artemis P. Simopoulos, Chairman of the NCC. Dr. Jose Cordero of the Bureau of Epidemiology of the Center for Disease Control, Dr. Allan L. Forbes of the Food and Drug Administration, and Dr. Frederic C. Bartter of Audie Murphy Memorial Veterans Administration Hospital serve as consultants to the study.

On September 26, 1980, the Infant Formula Act of 1980 was signed by the President and became P.L. 96-359. Section 7(a) of the law states "The Secretary of Health and Human Services shall conduct a study to determine the long term effects on infants of hypochloremic metabolic alkalosis resulting from infant formula deficient in chloride. The Secretary shall report the results of such a study to the Congress." The NCC Office was given the responsibility for the preparation of the report.

In order to respond to the congressional mandate, a task force planned a series of two workshops. The purpose of the first workshop was to invite scientists with a background in neuroendocrinology, neurosciences, metabolism, learning and behavior, as well as pediatricians and nephrologists who already have seen a number of children. The four major areas to be addressed by the participants at such a workshop were:

1) define the population to be studied;

2) determine how to best do the study, i.e., expand the present study or develop a collaborative study with infants to be studied in other centers;

3) develop detail protocols for the study; and

4) determine how long the children should be followed in order to determine the long-term effect on infants of hypochloremic metabolic alkalosis resulting from infant formulas deficient in chloride.

The second workshop included in addition to the members of the task force, parents of children with hypochloremic metabolic alkalosis, representatives from the Infant Formula Council, and representatives from Syntex, the producer of Neo-Mull-Soy and Cho-Free.

WHO/FAO MEETINGS

As in previous years, the NCC Office, through its Chairman, participated in a number of committee activities involving the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) of the United Nations.

As one of the U.S. delegates, the NCC Chairman represented DHHS at the Joint WHO/UNICEF Meeting on Infant and Young Child Feeding held in Geneva, October 9-12, 1979. The purpose of the meeting was to discuss what is the best form of infant feeding in both the developed and developing countries (with emphasis on the latter) and the problems that are raised consequent to the marketing policies of the companies that are selling infant formulas and weaning foods.

During the 3-day meeting, five workshops dealing with various issues were held. The following two major recommendations emerged from the meeting: 1) The need to develop an international code of ethics regarding the marketing of infant formula exists; and 2) each country, developed or developing, is responsible (legislatively or otherwise) for the control, sale, and distribution of infant formula. In addition, the delegates were asked to begin to elaborate a marketing and promotion code--acceptable to the producers, the exporting countries, and the governments of lesser developed countries--that would maximize the benefits and minimize the dangers of infant formula use in the lesser developed countries.

The NCC Chairman served as Technical Advisor to the U.S. delegation at the WHO Meeting on the "Third Draft of the International Code of Marketing of Breast Milk Substitutes," held on September 22-27, 1980, in Geneva, Switzerland.

In addition, the Chairman represents the NIH on the Interagency Committee on the International Code of Marketing of Breast Milk Substitutes contributing to the development of the U.S. position. Nutrition research is also an area of interest to the U.S.-Egypt Joint Research Activities. The NCC Chairman is a member of the Nutrition Subcommittee and represents NIH on the Project Review Advisory Committee (PRAC) for U.S.-Egypt Joint Research Activities.

DHHS NUTRITION COORDINATING COMMITTEE/POLICY BOARD AND THE SUBCOMMITTEE ON NUTRITION RESEARCH AND RESEARCH TRAINING

Following a year of deliberation, a dual structure for the DHHS Nutrition Coordinating Committee (DHHS/NCC) was formulated. This dual structure includes the DHHS/NCC that consists of the Chairman, the Executive Secretary, the Senior Staff Advisor and representatives from 19 agencies and offices within DHHS and a Policy Board that consists of the DHHS/NCC Chairman, the Executive Secretary, the Senior Staff Advisor, and the Chairpersons of the six Subcommittees of the DHHS/NCC. The six Subcommittees are: Nutrition Education, Nutrition Research and Research Training, Nutrition Services, Nutritional Status Monitoring, Food Safety Regulation, and International Nutrition. The entire DHHS/NCC meets six times per year on the "even" months while the Policy Board meets six times per year on the "odd" months. The NIH-NCC Chairman represents NIH at the DHHS/NCC and its Policy Board, and chairs the Subcommittee on Nutrition Research and Research Training. The NIH-NCC members and NCC staff also represent the NIH on the Food Safety Regulation, Nutrition Education, and International Nutrition Subcommittees.

THE JOINT SUBCOMMITTEE ON HUMAN NUTRITION RESEARCH (JSHNR), OF THE FEDERAL COORDINATING COUNCIL FOR SCIENCE, ENGINEERING AND TECHNOLOGY (FCCSET), OFFICE OF SCIENCE AND TECHNOLOGY POLICY (OSTP), EXECUTIVE OFFICE OF THE PRESIDENT.

The Committee on Health and Medicine (CHM) and the Committee on Food and Renewable Resources (CFRR) of the Federal Coordinating Council for Science, Engineering and Technology (FCCSET) established the Joint Subcommittee on Human Nutrition Research (JSHNR) because of the vital importance of the benefits from human nutrition research to the welfare of the American people and the world population, and the need for nutrition research efforts of the Federal agencies to be mutually reinforcing. The JSHNR is cochaired by representatives from DHHS and USDA. The Chairman, NCC, is the DHHS representative and serves as Cochairperson and Executive Secretary of the Subcommittee. The Administrator, Human Nutrition Center, SEA/USDA, represents USDA on the Subcommittee and serves as Cochairperson. In addition to DHHS, USDA, and OSTP (ex officio), seven other agencies are represented on the Subcommittee: Department of Commerce, National Oceanic and Atmospheric Administration (DOC/NOAA); Department of Defense (DOD); Federal Trade Commission (FTC); International Development Cooperative Administration, Agency for International Development (IDCA/AID); National Science Foundation (NSF); and the Veterans Administration (VA). On March 11, 1980, the National Aeronautics and Space Administration (NASA) was asked to join the JSHNR.

The scope and the purpose of the Subcommittee are as follows:

Scope: The Subcommittee is concerned with: (1) all Federally supported or conducted research on nutrition with emphasis on human nutrition; and (2) professional personnel needs in nutrition research and education.

This includes:

- Basic physiological and biochemical mechanisms for the digestion, absorption, metabolism, and transport of nutrients; the role of food ingredients in human health and performance and in the prevention and treatment of disease.

- Nutrient composition of foods; the effects of storage, processing, and packaging; and the biological availability of nutrients in the foods at the time of consumption.

- Determinants of dietary practices and methods for educating the public about dietary practices.

- Food consumption patterns and nutritional status of the general population and of special high-risk subgroups within the population; evaluation of the nutritional impacts of various intervention strategies and public policies.

- The professional personnel to carry out research on human nu-

trition; training programs in nutrition research and nutrition education in medical schools, dental schools, schools for allied health professionals, schools of nutrition, teachers' colleges, and schools of food and agriculture; nutrition education at the primary and secondary school level; and the manpower needs for education of the public.

Purpose: The purpose of the JSHNR is to increase the overall effectiveness and productivity of research efforts in nutrition. In fulfilling this purpose, the Subcommittee will:

a. Improve planning, coordination, and communication among Federal agencies engaged in research on nutrition.

b. Develop and update plans for Federal research programs to meet current and future domestic and international needs for nutrition.

c. Collect, compile, and disseminate information on nutrition research.

d. Prepare reports describing activities, findings, and recommendations of the Subcommittee.

To assist the Chairman in carrying out the responsibilities of the Executive Secretary of the JSHNR, Thomas P. Vogl, Ph.D., joined the Office staff in March 1979.

The Subcommittee issued its first report, Federally-Supported Human Nutrition Research, Training and Education: Update for the 1980's I. Human Nutrition Research and Training, on December 5, 1980. This report, presented in three parts and four appendices, indicates that human nutrition research is a vast area that will continue to require a focus for planning and coordination at the Federal level. Dr. Frank Press, the Director of the Office of Science and Technology Policy, transmitted the report to a selected number of Senators, Congressmen, and their staff, and members of the scientific community. The report was issued as a supplement to the May 1981 issue of the American Journal of Clinical Nutrition. Printed copies may be purchased by check or money order for $9.50 and copies on microfishe for $3.50 from the National Technical Information Service, (NTIS), 5285 Port Royal Road, Springfield, VA 22161 (Document Number PB81-128944).

The JSHNR plans to complete two additional reports in this series by December 1981. The second report will focus on International Nutrition Research, and the third report will discuss Nutrition Education Research, Education for Professionals, and for the Public.

IV.
APPENDICES

APPENDIX A

NUTRITION POLICY OF THE NIH

Policy Objectives:

The NIH supports DHHS policy by sponsoring and conducting biomedical research designed to improve the quality of life for all Americans through optimal nutrition. Basic biomedical nutrition research will develop knowledge needed to promote and maintain health, as well as to prevent and treat disease.

Nutrition research has passed through two stages and is now entering a third. The first stage saw the discovery of vitamins and the development of many of the basic nutritional requirements. The second stage reduced nutrition to subcellular and molecular terms within areas of biochemistry and physiology. The third stage calls for a synthesis of newer findings for translation into practical information to assist the individual to develop normally, to avoid disease, and to live as long and as healthy a life as possible. For this third stage, knowledge is needed that will permit distinction among individuals in terms of genetic differences that affect dietary requirements.

Areas of Emphasis:

Current nutrition research at NIH concentrates on eight critical areas:

1. Clinical Nutrition Throughout the Life Cycle. Research in this initial area examines variations in nutritional requirements to promote and maintain health during all phases of the life cycle. Within the clinical nutrition program, research is also directed towards elucidating the effects of infant feeding practices and infant nutrition on subsequent physiological, immunological, and mental development. Another research goal involving the life cycle is to understand the effects of maternal nutritional status and maternal diet before and during pregnancy on the development of the fetus. In order to understand the ramifications of this nutritional problem, more must be learned about the interaction between the genetic makeup of an individual and his dietary intake. Special emphasis is given to studies on the role of nutrition in health of the aged and aging process, particularly the effects of aging on nutrient utilization, digestion, absorption, and metabolism, and nutrition and age-related mental deterioration.

2. Role of Nutrition in Disease Development. The NIH conducts research on mechanisms by which dietary deficiencies, imbalances, and excesses lead to the development of physical and mental diseases and disorders.

3. Prevention of Disease. The NIH has assumed a leading role in shifting the emphasis in nutrition research from curing disease after symptoms have developed to preventing or delaying the onset of disease. Continued research emphasis is given to malnutrition in all its guises, including under- and over-nutrition, obesity, food faddism, and specific dietary deficiencies.

4. Treatment of Disease. The NIH develops nutritional therapies for specific diseases, such as cancer, gastrointestinal disorders, obesity, osteoporosis, renal insufficiency, atherosclerosis, and inborn errors of metabolism. Improved methods are being developed to provide general nutritional support for newborns of low birth weight who may require parenteral supplementation and for elderly, disease-ridden, traumatized, or post-operative patients who may require total parenteral nutrition or elemental diets.

5. Technology Transfer. An important component of the NIH nutrition policy is to assure appropriate application of research in practice. To expedite transfer of nutrition technology, the NIH is establishing mechanisms to evaluate research data relevant to nutrition and public health.

6. Nutrition Education. The NIH continues to support research in nutrition education as by-products of clinical trials and demonstration projects; by the education of the physician through professional societies, scientific meetings, and journals; and by the production of nutrition education materials for the health educator and the public. Encouragement of positive nutrition behavior is an obvious task for educators of children, young adults, and the elderly.

7. Research Training. The NIH encourages and supports the teaching of modern biochemical nutrition at the pre- and post-doctoral levels. This training includes the disciplines upon which nutrition research is based, such as gastroenterology, endocrinology, metabolism, developmental biochemistry, genetics, and molecular biology. The NIH also promotes expanded training programs in basic and clinical nutrition research aimed principally at the physician investigator and clinically oriented biomedical scientists.

8. Coordination. The NIH cooperates in establishing mechanisms for interagency coordination. Nutrition research at the NIH is coordinated through the Nutrition Coordinating Committee. Institutes initiate their own nutrition programs within their appropriated budgets. The Committee seeks agreement on critical issues of definition, comments upon individual programs identified to it, maintains an information exchange (mechanisms for program development), promotes liaison with other Federal agencies, and encourages coordinated program planning among Institutes and with other appropriate agencies. The Committee assists in the development of nutrition data retrieval systems, and reviews legislative and regulatory initiatives that impact upon human nutrition research.

APPENDIX B

MANDATE OF THE NIH NUTRITION COORDINATING COMMITTEE

The Nutrition Coordinating Committee:

- Reviews and comments on the plans, execution, and results of pertinent Bureau, Institute, and Division research efforts relating to nutrition in order to develop the Annual Report of the NIH Program in Biomedical and Behavioral Nutrition Research and Training.

- Processes and responds to incoming requests for nutrition information from the DHHS and other Federal agencies, the Executive Branch of the Government, the Congress, outside institutions, and the public.

- Maintains up-to-date information on funding and on intramural and extramural research and training activities in nutrition.

- Develops and monitors means for improving the coordination of these activities.

Within the scope of the major activities described above, the NCC has the following specific functions:

- To define nutrition research at the NIH. (Accomplished, see page 3.)

- To develop a policy statement for research and training in nutrition at the NIH. (Accomplished, see page 95.)

- To establish information exchange. Each representative presents to the NCC any new plans, activities, conferences, and workshops that are concerned with nutrition. Future workshops and conferences are discussed to ensure full participation of all relevant Institutes; when many Institutes are involved, the NCC sponsors or co-sponsors such workshops or conferences. Through the information exchange mechanism, the NCC identifies areas of collaboration for further research. The NCC informs the NIH nutrition community of all meetings, both within and outside NIH, concerned with nutrition. The Committee, if requested, also reviews and comments on nutrition reports generated by the NIH and by other Federal and non-Federal agencies.

- To develop a data retrieval system for research and training in nutrition. (Accomplished, see page 3.)

- To review proposed legislation and regulations. The NCC develops mechanisms for receiving, reviewing, and distributing information on proposed legislation affecting nutrition policy.

- To develop and maintain effective liaison with other departments and agencies that have nutrition activities. The NCC assesses existing liaison mechanisms and identifies those departments and agencies requiring a liaison relationship. Liaison representatives provide information to the NCC.

- To encourage the application of nutrition research to practice. The NCC members identify research data that are ready for "technology transfer" and promote the appropriate application of new knowledge in nutrition.

- To promote the dissemination of information for the purpose of public education on the role of nutrition on health and disease. The NCC assists in coordinating Bureau, Institute, and Division efforts in nutrition education and acts as a focal point for the dissemination of nutrition information to the public.

APPENDIX C

FY 1980 SPECIAL INTEREST AREAS IN NUTRITION

NUTRITION AND PREVENTION OF DISEASE

Approximately 43 percent of the nutrition research supported in FY 1980 by the NIH was concerned with the prevention of disease or was directed toward obtaining information that would lead to preventive measures. The total obligation in this category was $59.8 million; support was provided by DRR, NCI, NEI, NHLBI, NIA, NIAID, NIAMDD, NICHD, NIDR, and NIEHS.

The working definitions used by the NCC for prevention are as follows:

Primary prevention. Actions to promote health or undertaken prior to the development of disease.

Secondary prevention. Detection of disease in its early (asymptomatic) stages and intervention to arrest its progress.

Tertiary prevention. Intervention after the development of a clinically manifest disease in order to reverse or arrest its progression.

In studies involving the early stages of the life cycle, much of the research deals with dietary intervention in primary prevention as a means to prevent the development of secondary effects such as mental retardation; to compensate *in utero* for placental insufficiency; to determine the nutritional status of the pregnant woman; to supplement the diet of previously malnourished children; and to determine quantities of essential nutrients needed for optimal development of the normal person. The goal of much maternal-fetal nutrition research is to prevent intra-uterine growth retardation and to assure optimal fetal development and the birth of healthy babies. Research on nutritional therapy for high risk infants, especially those born prematurely, aims to identify and preserve specific components of human milk and colostrum in an attempt to minimize potential problems of failure to thrive, growth retardation, and newborn infections. Nutritional therapy of infants and children with inborn errors of metabolism is designed to prevent or ameliorate the full expression of these genetic disorders.

Another group of studies deals with malnutrition and the immune system. Interests are focused on modulating effects of specific nutrients on immune function and resistance to infections; the effect of enteric infections on nutrient absorption and child growth; the modulating effect of trace nutrients on microbial virulence, as well as the mechanisms of food allergies and immune response to ingested antigens.

Also of interest is research that examines the effects of varying amounts of dietary substances on the function of various target organs and aging, and the effect on longevity. For example, in a longitudinal study of rats from weaning to senescence, three different dietary fats and two

types of tocopherol are administered to determine the polyunsaturated/saturated fat ratios and vitamin E levels optimal for survival; this study will measure the effects of these substances on a number of structural and biochemical changes in brain, heart, and liver as well as on lifespan. A study of the interactions of ozone as an air pollutant, dietary vitamin E, and various unsaturated fats will focus its examination on the lung as a target organ. Another project will study the effect of tryptophan restriction on the aging of rats in relation to anterior pituitary function, neurotransmitter levels, and spontaneous tumor development. Changes in mitochondrial metabolism and the function of other intracellular organelles are also studied. Another project seeks to obtain information on the effects of prenatal malnutrition on aging and longevity with particular reference to the brain. Other studies concern riboflavin and vitamin A deficiency and their influence on protein and energy requirements.

Other research on nutrition and the prevention of disease includes studies on: the role of dietary fiber in digestion and absorption, and transit time in the gut as related to prevention of such diseases as diverticulosis, diverticulitis, gallstones, hemorrhoids, coronary heart disease, and cancer of the colon; function of trace elements and newly recognized dietary essential minerals; the bioavailability of nutrients and the factors that may influence nutritional requirements of individuals; and methods for measuring nutritional status with the establishment of nutritional guidelines. Projects aim to expand knowledge on how cultural aspects of the environment affect children's nutritional status, and to consider the problem of overnutrition and obesity as well as its metabolic concomitants of insulin resistance and glucose intolerance. Much of this research attempts to develop ways to modify and improve unhealthy dietary practices, especially among nutritionally vulnerable groups such as pregnant women, young children and adolescents.

The prevention of dental caries, periodontal disease and oral-facial abnormalities due to nutritional deficiencies, or excesses, is of considerable interest in nutrition research. Projects include determination of the systemic effects of deficiencies and excesses of protein, vitamins, and trace elements such as fluoride, in oral health and disease. The National Caries Program is conducting research to identify caries-preventive dietary food items.

The role of dietary antioxidants in protecting ocular tissue from oxidative damage is an area of research emphasis. The treatment of corneal disease with vitamin C is being investigated and clinical trials continue on the protection against induced retinopathies, particularly retrolental fibroplasia, with vitamin E. The role of vitamin A in the formation and functioning of the retina and the cornea, and possible nutritional relationships to cataract formation is also under investigation.

Food toxicology comprises another major portion of research in nutrition and prevention. Exploration of the human health hazards of natural products and contaminants, toxic environmental agents intentionally or incidentally introduced into foodstuffs, and changes associated with

food storage and processing, includes studies on the toxic risks and effects of ingested contaminants on the primary digestive system with emphasis on mechanisms of transport through the gut. The interactive relationships between exposure to environmental contaminants and nutritional factors (e.g., fasting, dehydration, dietary deficiencies, and supplements) are explored in terms of the effect on toxicity and possible pathogenesis.

The carcinogenic potential of certain food products and food processes are also under investigation. The influences of various methods of thermal processing, such as spray drying, drum drying, pasteurization and cooking by frying, broiling, and microwave, and conditions that contribute to the formation and occurrence of carcinogenic n-nitroso precursors in various foods including meat, cheese, and milk are being studied. Methods are being developed to detect, identify, and classify nitrosamines that may be found in the food supply. For substances already identified, research is underway to assess a chemical compound's relative hazard and to develop food processing procedures that will eliminate or minimize their effect.

Another large group of studies is underway to identify individuals at high risk for cancer long before clinical symptoms become manifest. Research is in progress to study the genetic predisposition of young women to nutrition-related malfunctions of the immune system that permit the process of carcinogenesis, particularly in the breast. Studies are examining interactions between ethanol and the metabolic activation of chemical carcinogens in order to identify possible molecular mechanisms by which ethanol increases the risk of colon, esophagus, and liver cancer from chemical carcinogens. The role of dietary factors such as fat, zinc and cadmium, and vitamin A in the etiology of prostate cancer is also under investigation. Nutritional epidemiological studies offer the potential of identifying factors that promote or retard cancer, and of recommending specific dietary/lifestyle changes to the American public, particularly in regard to dietary intake of fats and fiber.

Studies being conducted in rats range from testing the theory that undernourishment increases life span, diminishes the incidence of cancer and also prevents aging of the immunological system, to research on specific dietary components such as the anticancer properties of vitamin A and its synthetic analogs, the effect of diet on the humoral and cellular immune response, the relationship of obesity and weight loss to the metabolism of estrogen and other steroid hormones, the influence of antioxidants such as BHA, and BHT, as well as vitamin E and dietary selenium on carcinogenesis, and the influence of dietary fat types, individual fatty acids and dietary-fat/selenium interaction on the development of spontaneous mammary tumors.

In order to look at changes at the cellular level brought about by the interactions of various dietary components and organotropic carcinogens, alkylating agents and antimetabolites, studies are underway to look at the effect of zinc, selenium, B-sitosterol, lithocholic acid, deoxycholic acid, and vitamin C on colonic epithelial cells. These studies hope to

identify whether any of the dietary components modify any acute reactions of the cell, and at what stage of the cell's damage and repair cycle they may operate. Extensive research is also underway on vitamin C, pyridoxine and fiber, substances supposedly having some type of anticancer property.

A large number of grants and contracts are related to the prevention of cardiovascular disease. Many of the clinical trials, such as the Multiple Risk Factor Intervention Trial (MRFIT), Lipid Research Clinics, Coronary Primary Prevention Trial, The Minnesota Heart Program and the Dietary Intervention Study of Hypertension use counseling and other techniques to change diet, and the use of diet in the prevention of heart disease. The role of lipids in arteriosclerosis, the role of sodium and body weight in hypertension, the effect of diet on the composition and metabolism lipoproteins, including high density lipoprotein (HDL) and the role of HDL in prevention of cardiovascular disease, and other dietary changes to reduce its risk are a major concern in prevention programs.

The Clinical Nutrition Research Units (CNRU) and the Obesity Center emphasize the importance of strengthening nutrition research and presenting information on the relationship of nutrition and disease prevention.

NUTRITION AND GENETICS

Biochemical genetics has advanced our understanding of the interactions between heredity and nutrition, of the development and treatment of certain diseases, and of normal development and disease prevention. In the genetics and nutrition program at the NIH, research on the effects of nutrition and dietary intervention on inherited diseases and conditions is supported by the DRR, NCI, NEI, NHLBI, NIA, NIAMDD, NICHD, NIEHS, and NINCDS. The obligation in this special interest category was $12.6 million or 9.0 percent of the total cost of the nutrition program in FY 1980.

Genetics and nutrition research is concerned with such areas as: inborn errors of metabolism including vitamin dependencies; determinations of cellular function, especially DNA repair mechanisms; chromosomal aberrations; protein synthesis; metabolic disorders; obesity; and the role of dietary control of inherited diseases, including the hyperlipoproteinemias, diabetes, and sickle cell anemia.

A number of projects involve the nutritional, biochemical and metabolic aspects of a number of inborn errors of metabolism, including phenylketonuria, galactosemia, maple syrup urine disease, hyperlysinemia, isovaleric acidemia, Menkes' kinky hair syndrome, glycogen storage disease, etc. It is often possible by various dietary manipulations to overcome or bypass enzymatic defects that characterize certain inborn errors of metabolism. Elimination diets are commonly employed in order to prevent an accumulation of nutrient substrates in metabolic pathways prior to the enzymatic defects. Other inborn errors of metabolism can be ameliorated by providing in the diet increased quantities of the metabolites that lie in the

pathways beyond the deficient enzymatic reaction. One study is characterizing, through biochemical, immunological, and genetic approaches, the inherited variation in activity of galactokinase and galactose-1-phosphate uridyltransferase. In other work, the emphasis is on the interaction between trace elements and genetics in the mammal. Studies are also underway on the metabolic effect of nutrients on hereditary metabolic disorders that cause neurological abnormalities.

Differences in individual requirements for dietary-essential nutrients may be due in part to genetic variations that affect metabolic pathways and thereby the ability to utilize ingested nutrients. Thus, several research projects are aimed at achieving a better understanding of the metabolic role of diet in the causation, prevention, and treatment of genetic diseases and conditions. Carbohydrate metabolism, amino acid transport, the urea cycle, iron metabolism and iron storage, and zinc metabolism are being studied in light of genetic effects. Studies on the nutritional aspects of genetic diseases and some conditions include: trace mineral metabolism and chondrodysplasia; iron-hooding in sickle cell disease; iron-storage disease in Cooley's anemia (Thalassemia major); familial zinc binding abnormality; the nutritional aspects of genetic defects in the urea cycle; pigmentation and inherited disorders; inherited metabolic and nutritional causes of arthritis; and familial aggregation of inflamed bowel disease. Included also are studies on hereditary diabetes in the mouse; growth of preadipocytes in the genetically obese rat; and the molecular nature of rdrd mutation in chickens.

Research on the dietary management of the urea cycle enzymopathies has resulted in the use of keto-acid analogues instead of essential amino acids. In some studies, for example, ketoisocaproic acid replaces leucine, and the nitrogen-free keto analogues of valine, isoleucine, methionine, and phenylaline are being used. In addition, experiments are underway on alternative metabolic pathways for excretion of excess ammonium and other nitrogen metabolites. Hippuric acid, phenylacetylglutamine, arginine, citrulline and arginosuccinic acid may serve as possible end points of nitrogen metabolism. Beneficial effects of oral administration of sodium benzoate or phenylacetic acids in decreasing plasma ammonium levels have also been demonstrated in patients with urea cycle enzymopathies.

Phenylketonuria (PKU), a disorder that occurs approximately in 1 out of 14,000 births and requires a low phenylalanine dietary regimen has received much research attention. Biochemical, anthropometric, and behavioral studies of 150 children enrolled in the Collaborative Study of Children Treated for Phenylketonuria are underway to determine the appropriate age of a child at which a normal diet can replace a low phenylalanine diet without affecting cognitive development. Other studies are determining the effects of using twice the normal levels of dietary leucine, isoleucine, and valine in addition to restricting phenylalanine in infants with PKU, as well as looking for the optimal dietary regimen for maternal PKU. Two animal studies, one in rhesus monkeys and one in rats, are also underway to investigate the parameters of maternal PKU.

In other animal studies, the effect of dietary lysine levels and vitamin deficiency on brain lysine metabolism is being examined by an intraventricular injection technique, as well as by analyzing the enzymes involved in lysine metabolism. The metabolism of lysine, the neurochemical roles of lysine metabolites as neurotransmitters or transmitter antagonists, and the kinetics of the blood brain barrier transport of lysine metabolites are under investigation. The degree of glyoxylate accumulation in thiamin deficiency is being investigated in order to establish whether elevated levels of glyoxylate account for the specific symptoms of thiamin related disorders. Different tissues are being examined to determine whether or not a metabolic basis exists for the differential tissue susceptibility to thiamin deficiency.

Research on the implications of genetics and nutrition to the aging process is another important area. Thus, research is being conducted to analyze nutritional and genetic factors regulating the lifespan and patterns of aging of Caenorhabditis elegans. Behavioral, physiological, and molecular parameters will be tested with nematodes grown on diets yielding very different lifespans.

In the area of environmental health, research consists primarily of investigations into the mutagenicity or mutagenic mechanisms of foodborne environmental contaminants and natural products. Mutagenesis-carcinogenesis associations comprise a significant part of this effort.

Other studies on genetics, nutrition, and carcinogenesis include: studies on differentiation and neoplasia carried out in an effort to characterize the transformation protein encoded with the sarc region of the Rous genome and to understand chromosomal packaging in human leukemia cells; studies on both the metabolic and genetic control mechanisms of amino acid synthesis in human and animal tumor; studies on the isolation and analysis of DNA mutation of cancer cells; the involvement of alkylation by nitrosated polyamines and of nitrous acid in mutations; studies to find methods of overcoming the rejection of transplanted organs; in vitro somatic cell genetic analysis of human cells; studies to characterize viral-specific macromolecular disturbances that accompany viral induced malignancies, and the modulation of DNA mutation frequencies and DNA repair frequencies by environmental factors, including nutrients.

In an attempt to identify individuals at risk before clinical symptoms become manifest, investigations on the possibility of detecting genetically susceptible women at high risk of breast cancer are underway. Such studies may determine if more than one genetically influenced form of breast cancer exists, and thereby elucidate the pattern of transmission in families. A further objective is to identify the protein product of the susceptible gene(s) by monitoring as-yet-unaffected individuals. Another study attempting to recognize markers specific to a cancer prone genotype is looking at families with hereditary site-specific colon cancer. These studies have important implications for identifying high risk patients in the general asymptomatic population.

Studies are measuring the familial aggregation of plasma lipids and lipoproteins in order to determine the prevalence of familial lipid disorders and to clarify the mode of inheritance of serum lipid patterns. One project is studying the role of variation in lipoprotein phenotypes in determining hypercholesterolemia and certain forms of atherosclerotic disease. A specialized center in arteriosclerosis is doing new research on genetic and non-genetic factors affecting the structure and composition of apolipoproteins and research on familial hyperbetalipoproteinemia. Other studies are investigating sodium intake and familial aggregation of blood pressure. The role of dietary habits and parent-child associations in blood pressure are being studied in Seventh Day Adventists.

BEHAVIORAL STUDIES IN NUTRITION

The nutritional status of an individual depends not only on the physiological regulation but also on the motivation controlling food intake and food selection. Regulation and motivation, in turn, are governed by a set of peripheral variables (taste, smell, gastric factors, and humoral and metabolic factors) that are integrated in the central nervous system where they may be greatly influenced by learning of habits, and social, cultural, and religious values. The very important role of learning and habit in food preferences and aversions is thus an essential aspect of this part of nutrition research. Research is also conducted on the ways in which excess or deficient intakes of various foods or nutrients may influence certain behaviors. In FY 1980, the NIH funding level for behavioral studies in nutrition was over $22.7 million, or 16.3 percent of total nutrition research and was supported by DRR, NCI, NHLBI, NIA, NIAMDD, NICHD, NIEHS, and NINCDS.

A substantial portion of NIH research in this category is concerned with the possible deleterious effects of the cycle of malnutrition and behavior, attempting to pinpoint the nutrient and environmental deficits, and to determine the extent to which findings in animal subjects are also relevant for human populations. Studies on the effect of malnutrition on behavior include human and animal studies of protein-energy malnutrition, iron deficiency, zinc deficiency, and lead toxicity. One research project is designed to determine whether dietary supplementation, alone or with a program of psychological stimulation, prevents cognitive and other behavioral deficiencies among infants born into poor Colombian families. The behavioral concomitants of iron deficiency, with and without anemia, are being examined in terms of alertness, social behavior and task related behaviors in infants, 6 to 24 months old, and in terms of learning, attention span, and memory function in school age children.

The behavioral effects of lead exposure from dietary, maternal, and air borne sources are being considered in studies designed to examine the neuropsychological performance of infants with high and low levels of blood lead, and school children with high and low levels of dentine lead. Studies of intellectual development and academic achievement of children with phenylketonuria (PKU) are also underway.

Animal models of undernutrition are used in research designed to determine the specific contributions of nutrient deficiencies to abnormal cerebral development and the behavioral sequelae. Studies in rats and monkeys are looking at whether behavioral abnormalities arise in the offspring of mothers fed diets containing as little as three percent protein and forty percent restriction of total food intake. Evidence to date indicates that early undernutrition alters motivation and emotional responsiveness to model situations later in life. Studies are also in progress on the effect of early undernutrition and subsequent nutrient rehabilitation on the motivation to ingest sucrose solutions of varying caloric density. In rat studies of iron deficiency, the emphasis is placed on operant conditioning. The behavioral effects of zinc deficiency in the monkey are being documented through a number of tests devised to look at climbing, exploration, manual dexterity, cerebral arousal, social motivation and behavior. In animal studies of behaviorial tests to assess reflexes, maze running, open field behavior and passive avoidance are underway in two different rat models of PKU. One model uses p-chlorophenylalanine to block phenylalanine hydroxylase while the other uses alpha-methylphenylalanine.

Food choices can be quantified and therefore can serve as definitive outcome measures in the study of developmental processes during infancy, childhood and adolescence. Of special interest are studies on the determinants of food selection and aversion, and studies on the determinants and controls of food intake at critical stages of the life cycle, i.e. pregnancy, infancy, childhood and adolescence. Investigations on the neurochemical determinants of behaviors along with the historical, geographical, evolutionary, cultural and psychological factors that influence ingestive behavior are necessary. Currently, specific areas of research include the development of a child's conception of food and taste preferences; an ecological assessment of nutritional status of families living in Kenya; the effect of television food commercials on children's eating habits; the effect of westernization on infant feeding practices of the Negev Bedouins; and the effect of social class on infant feeding practices of the Pima Indians.

Other research involves studies of the neuroendocrine influence on dietary preferences and feelings of satiation, and on feeding and drinking behavior generally. Food selection and regulation is effected by the peptides cholecystokinin, nerve growth factor, and the opioid polypeptide, but their exact role needs elaboration. Studies on internal sensing systems and drinking behavior; adaptation and sensory coding in taste; neural systems of ingestive behavior; and psychobiology of stress-induced behavioral deficits are underway. In research on angiotensin, studies are underway to investigate its role in the development of thirst and sodium appetite and to look at selective competition of the antidipsogens, such as prostaglandin E and substance P, with angiotensin's dipsogenic action.

Studies on the contribution of the sympathetic nervous system to weight regulation are also underway in order to look at the concomitant effects of brain lesions, that cause overeating and obesity, on gastric ulceration, fat mobilization, and pancreatic hormone levels. Insulin has also

been found to increase satiety cues and reduce overall food intake. Other research is attempting to analyze the integration of the neural systems by which gustatory, oropharyngeal, visceral and olfactory stimuli influence food intake, and how this integration influences feeding behaviors. Research is being done to determine the capacity of the hindbrain and forebrain to integrate gustatory information into complex feeding behavior. Some studies in rats indicate that the set-point for body weight is determined, in part, by circulating levels of steroids. The effects of steroids on behaviors that affect body weight and the pathways of their action in the brain and peripheral tissues are being considered.

Research on food avoidance and taste aversion includes neurophysiological studies using surgical and pharmacological techniques. These studies indicate that poor diets, especially poisonous foods, reduce taste palatibility while nutritious diets increase taste palatibility. Studies are also underway on the motor organization of feeding behavior as determined by the sequence activation of individual muscles of the buccal cavity following food sensory stimulation. The buccal ganglion neurons that contact the buccal muscle upon activation by food sensory stimulation will be identified and classified.

The effect of amounts and balance of ingested amino acids on concentrations of neurotransmitters is also being studied, as the levels of brain serotonin, dopamine, and acetylcholine may influence feeding behavior. The ratio of serum tryptophan or tyrosine to other large neutral amino acids in the serum is correlated highly to their rate of uptake by the brain. Dietary factors that influence insulin secretion may also affect amino acid uptake by the brain. Research has shown that because insulin enhances the rate of uptake of the large neutral amino acids, leucine, isoleucine, and valine by striated muscle, the rate of tryptophan and tyrosine uptake by the brain is improved. This allows for an increased production of serotonin and dopamine in the brain. Studies are underway on the use of oral tyrosine in patients with Parkinson's disease, depression, and hypertension because increased tryptophan and serotonin levels may help to increase growth hormone production and to reduce depression and high blood pressure. These studies emphasize the potential effect of diet, especially neurotransmitters, on behavior.

Neurobehavioral studies are conducted to determine the neurotoxic effects of exposure to food-borne environmental contaminants, and to explore the potential of subtle neurobehavioral change as an early indicator of health impairment. Also underway is an analysis of mechanisms and the formulation of principles dealing with climatic adjustment of animals exposed and adapted to extreme climates such as those that prevail in the northern environment of the United States and elsewhere.

A large group of studies is concerned primarily with factors that influence feeding behavior as it relates to the problem of obesity. For example, a major study of the factors involved in the eating behavior of obese and lean individuals has developed a system for the comprehensive study of individual cases, with the intent of developing ways of modi-

fying eating behavior and safely reducing the body weight of obese patients. Research is conducted to predict outcome in behavioral obesity treatment. In three studies of behavior modification on childhood obesity, parents are being trained to model the appropriate eating or exercise behaviors for their overweight children. Self-help techniques and behavioral modification practices are being used to reverse established obesity, and positive health and dietary behavior is being taught to preschoolers in order to determine if the development of obesity can be prevented later in life.

Considerable research centers around the application of behavior modification techniques in the treatment of patients with cancer or cardiovascular disease. Behavior modification intervention in the treatment of anorexia, and the evaluation of learned food aversion in the cancer patient includes hypnosis, biofeedback, and classical conditioning techniques. This kind of intervention is utilized to increase caloric and nutrient intake in both pediatric and adult cancer patients. Other approaches include development and distribution of information to help patients cope with cancer-related problems and tumor induced changes in eating habits.

Cancer patients treated with therapeutic regimens that induce gastrointestinal toxicity are being studied to determine whether they acquire learned taste aversions. The development of such aversions is followed with evaluation of its contribution to anorexia. Studies in neurophysiology indicate that the loss of appetite in cancer patients can be modified by manipulating the plasma concentrations of free or total tryptophan or other competing neutral amino acids, or by administering serotonin antagonists. Thus, altering the adverse behavior attributed to changes in the appetite center in the brain is a major focus.

Mass media and behavior modification are used to inform individuals at high risk of cardiovascular diseases, as well as the general public, of the dietary factors involved in cardiovascular diseases. Target groups receive information regarding the means by which individuals can maintain dietary control of physiological risk factors and thereby possibly delay or obviate such diseases. Some research projects are concerned with weight reduction and sodium restriction in the management of borderline hypertension. One study is looking at the possible potentiating effect of caffeine intake when combined with stress in the development of hypertension.

Evaluations are being made of the effectiveness of various behavioral intervention techniques. Two major projects in this category are the Multiple Risk Factor Intervention Trial, the Dietary Intervention Study of Hypertension, and the Lipid Research Clinics. The Stanford Five County Heart Disease Prevention Study approaches behavior change by combining the use of mass media with face-to-face instructions by professionals. The behavioral techniques under study for inducing dietary changes in families in order to maximally reduce high levels of plasma cholesteral include: increasing awareness of individual and family eating behavior, establishing environmental control of dietary cues, model-

ing of appropriate eating behavior, increasing the social desirability of the diet, and utilizing group process and dynamics.

EPIDEMIOLOGICAL RESEARCH IN NUTRITION

The NIH is the lead agency in epidemiological research in nutrition. The role of food habits and the socioeconomic factors that influence food selection in health and disease are important components in epidemiological research and various clinical trials using epidemiological tools are underway. In FY 1980, the NIH provided $18.4 million to support epidemiological research in nutrition; this is equal to 13.3 percent of total nutrition research. Programs in this area include those of DRR, NCI, NHLBI, NIA, NIAMDD, NICHD, and NIEHS. The scope of the NIH research effort in this area is described below.

The various NIH projects in epidemiology can be grouped in five basic categories: 1) evaluation of nutritional epidemiological procedures; 2) studies of early nutrition on physical and psychological development in defined populations; 3) nutrition-related epidemiological studies on maturation and reproductive function; 4) nutrition surveys of target or special population groups; and 5) epidemiological correlation of food intake to disease states.

The evaluation of epidemiological procedures is an important aspect of several studies supported by the NIH. For example, to assure that nutrition components of clinical trials use methodologies that produce reliable and valid dietary intake data and to assure compatibility of data among the trials, an evaluation has been undertaken of the dietary data collection system developed and shared by the Lipid Research Clinics and the Multiple Risk Factor Intervention Trial.

Epidemiological studies in nutrition are concerned with the effect of early nutrition on physical and psychological development, and with nutrition and maturation and reproductive functioning. Thus, research is being done in the following areas: the effects of protein-energy malnutrition on physical activity and work capacity in children and adolescents, the clinical correlates of vitamin D status in infants, early malnutrition and immunologic competence, the development of obesity in children, the effect of diet on the age at which children reach menarche, maternal nutrition and birth interval and the effect on lactation, i.e. milk production, and the occurrence of iron and zinc deficiency in pregnancy, infancy and childhood.

Nutrition surveys of target or special population groups are conducted in association with several projects. For example, epidemiological studies are underway to ascertain trends in breast and bottle feeding among various groups of women in this country and abroad. In order to determine the underlying reason for major differences in patterns of cancer incidence that characterize certain groups, epidemiological surveys are conducted to obtain information about dietary practices and cancer incidence in various populations that are at either very low or very high risk. One study is underway to identify risk factors among populations that have migrated.

Other comparative nutrition epidemiological studies are being conducted among American whites, blacks, and Spanish speaking persons, Mormons, and Seventh Day Adventists. The studies in the Mormons and Seventh Day Adventists are attempts to explain the lower incidence rates for cancer of the colon and sex linked cancers when compared to the populations at large in the same geographic area. Such studies seem to indicate an association between colon cancer and dietary fat and fiber intake. In the study of breast cancer etiology, the possible role of fats and cholesterol and the interrelationships between steroid metabolism and breast cancer incidence are being investigated. Current studies also focus on saccharin's role in bladder cancer, the incidence of cancer in vegetarians, and the characteristics of high risk groups for esophageal cancer. Information obtained from surveys aids in the development of hypotheses that can be tested in laboratory and animal studies.

The NIH supports research on the epidemiological correlation of food intake to disease states. These studies seek to determine the relative hazards or benefits of certain long-term dietary intakes in the human situation. Such research involves a diversity of population and ethnic groups, both in this country and abroad. One example is an epidemiological followup of the pharmacokinetic and toxicologic experience of an Iraqi population accidently exposed to methyl mercury through treated grain. Another is the study of stroke in a specific population where the factors (including nutrition) that influence survival after stroke and possibly contribute to the incidence of stroke are being investigated. Yet, other epidemiologic studies are concerned with the correlation of food intake to disease states or conditions such as diabetes, obesity, gallstones, and cancer of the colon, stomach, bladder, pancreas, breast, and liver. Research is underway to determine if an association exists between the quality of drinking water and the incidence of colon cancer. The two epidemiological studies on diabetes deal with the incidence of diabetes in Yemenites immigrating to Israel, and the possible causes of diabetes and obesity in American Indians.

Much of the NIH-supported epidemiologic research in nutrition is concerned with persons at high risk for coronary and vascular disease and a number of projects are underway: The Lipid Research Clinics Prevalence Study's data on lipid/lipoprotein distributions in ten North American centers compares the prevalence of lipid and lipoprotein levels in various age, race, ethnic and social groups. Special emphasis is on the relationship of lipids and lipoproteins to diet, and the relationship of atherosclerosis to lipid and lipoprotein levels. Two cohort studies, the Honolulu Heart Study and the Puerto Rico Heart Study assess the dietary habits and cardiovascular disease (CVD) risk factors in their respective populations that have been verified as having a low evidence of CVD. The data from these populations are then compared with data from populations in the U.S. known to have a high incidence of cardiovascular disease.

In the Framingham Heart Study, the role of diet on lipid and lipoprotein levels also receives major emphasis. Epidemiological studies are clarifying the role of major risk factors and investigating other traits as possible risk factors.

NUTRITION AND OBESITY

Nutrition research on the biomedical and behavioral aspects of obesity is an important area of consideration at the NIH. In FY 1980, the DRR, NCI, NHLBI, NIA, NIAMDD, NICHD, and NINCDS supported research in obesity for a total obligation of $9.8 million, or 7 percent of total nutrition research.

Obesity is a major public health problem in the United States, affecting both children and adults. According to national statistics, one out of three Americans are obese. Of all women between the ages of 37 and 70 approximately 30 to 40 percent are considered obese (at 20 percent over their desirable weights as suggested by life insurance statistics). Thirty percent of men in this country are considered obese, with some subgroups reaching even higher percentages of obesity. Children today are, on the average, 50 percent heavier than they were a generation ago. Furthermore, obesity is either a risk factor in or is associated with a number of diseases, including diabetes, hypertension, coronary heart disease, osteoarthritis, complications of pregnancy, and some infections.

The research effort at NIH parallels the extent of the problem, with studies encompassing obesity throughout the life cycle, as well as its relationship to specific diseases and conditions. Some of this research involves basic studies at the cellular level; an example is the study on nutrition and adipocyte growth and development. A different approach is taken in other research, in which the effects of regulating the appetite of the newborn are examined. Attempts to understand the neuroanatomical organization of areas of the nervous system responsible for the control of food intake and body weight regulation have begun. A large consortium project to describe the natural history of obesity in Americans and to ascertain the childhood antecedents to obesity is also underway.

Studies on the basic, clinical, metabolic, genetic, environmental and behavioral aspects of obesity include research on feeding behavior in humans and in animals, body weight management, weight loss, and the metabolic regulation of fat cell growth in size and number. Of particular importance is the multidisciplinary research on obesity being conducted at the Obesity Center at St. Luke's Hospital in New York City. Research has focused on eating behavior in various types of obesity, a study of peripheral signals of hunger and satiety in man, and the assessment of the effectiveness of "protein sparing" low calorie diets for use in reduction of body fat. These studies have revealed that low calorie diets are successful in promoting weight loss only when individuals are given a "highly palatible" diet, modified to contain less energy, and when fiber is added to the diet. The Center has also initiated a weight control unit to serve as a model of a comprehensive program for the study and treatment of human obesity. Optimal regimens are being developed for patient care, and new approaches will be tested. This Center has developed a universal eating monitor, which is used to measure eating rate and patterns of various types of foods in lean and obese subjects. Investigators at the Center are exploring the reasons that obese patients actually consume less in comparison with lean subjects eating the same

foods. They also are investigating obesity of different etiologies (genetics, overeating due to diet palatability, ovariectomy), which produce independent additive weight gains.

Other studies are under way on the central nervous system regulation of fuel mobilization and storage, regulation of fat cell size and fat metabolism, the effect of meal pattern and diet on energy metabolism, effect of exercise on lipid metabolism, factors affecting appetite and hunger, pancreatic function, thyroid function, diet selection, regulation of growth of adiposite tissue, human feeding behavior, behavioral techniques for weight loss, intestinal and gastric bypass operations in obesity, behavioral and metabolic correlates of genetic obesity, obesity and diabetes in pregnancy, and causes of diabetes and obesity in Oklahoma Indians.

Other research, in weaning rats, includes the study of the effect of surgical removal of subcutaneous fat depots on lipogenesis. It appears that such surgery has led to precise restoration of adipose mass and adipocyte number within 7 months. It is hoped that this research will lead to a determination of the role of adipose tissue in fat storage regulation and food intake control. In additional studies, it appears that obese zucker rats on energy restricted diets become equally as fat as "ad libitum" fed controls, and have lipoprotein lipase levels elevated as early as seven days of age. Several studies also have focused on a thyroid-dependent enzyme not found in the genetically obese mouse as a means of evaluating the possible mechanisms involved in human obesity, as well as on elucidating the neuroanatomical pathways and areas of the brain that control food intake and body weight. This research hopes to determine whether possible anatomical abnormalities exist in the brains of genetically obese rats.

During the past year, investigations have emphasized the different effects of thermogenesis as a factor in obesity. The factors that increase sodium potassium atpase and thereby illicit energy production include; exposure to cold temperatures, force feeding, protein malnutrition accompanied by increased serum triiodothyronine and thyroxine, and feedings of medium chain as opposed to long chain fatty acids. A primary site of free energy production is in "brown fat" adipocytes that increase upon exposure to cold temperatures. It has been noted that rats fed ad libitum accumulate more "brown fat" and are leaner than pare-fed, meal-fed rats. Infra red photography techniques have shown the areas of "brown fat" accumulation in humans to be the back of the neck, the center of the back, and the chest.

Research on the aged and the aging process includes studies on obesity. One study, for example, is identifying age-related changes in fatty acid content in several tissues and is determining the effect of age on the rate of lipogenesis. A second project will measure a variety of parameters of cholesterol metabolism in rats to identify strain differences and find their underlying physiological cause.

Obesity as a risk factor in coronary heart disease and hypertension is

studied extensively in various NIH projects, including the Multiple Risk Factor Intervention Trial, the Lipid Research Clinics, the Dietary Intervention Study of Hypertension, and the Stanford Five City Multifactor Risk Reduction Study. Related research projects include studies on: the effects of metabolic surgery on the hyperlipidemias; antilipemic regimens in peripheral arteriosclerosis; and prevention of high blood pressure in children. Obesity as a risk factor in adult onset diabetes is under investigation. Intervention projects are underway to reduce and sustain reduction in overweight and obesity in hypertension-prone persons.

Other research on obesity includes studies on the effect of diet and obesity on hormone metabolism and subsequent tumor development and growth in both animals and humans. Because hormones have been implicated in the onset and growth of tumors, the rate of metabolism of steroid hormones specifically androgen, estrogen, and cortisol is being examined in obese women undergoing drastic weight reduction and dietary manipulation. Additional studies in animals are investigating the effects of high and low fat diets, reduced caloric intake, and hypothalamic-induced obesity on serum hormone levels, specifically prolactin and estrogen, and the development and growth of mammary tumors.

The effects of starvation on myocardial structure and function; life change events and overweight; anthropometric assessment for screening and surveillance of infantile obesity; maternal obesity and carbohydrate intolerance on fetal outcome; conservation of lean body mass during total starvation of obese subjects; dietary, hormonal, and genetic determinants of obesity; hypothalamic control of body weight and feeding; insulin and central nervous system control of body weight and feeding; and weight-loss risk reduction through behavioral techniques are all parts of the puzzle being considered in research on nutrition and obesity.

NUTRITIONAL STATUS

In FY 1980, research on nutritional status was supported by the NIH for a total of $31 million or 22.3 percent of total nutrition research. Programs in this area include those of DRR, NCI, NHLBI, NIA, NIAID, NIAMDD, and NICHD. The scope of the NIH research effort is described below.

Research on nutritional status supported by the NIH includes studies that relate to requirements for essential nutrients in terms of nutritional status throughout the entire life cycle, from fetal life to infancy, childhood, adulthood, and the aged. Such studies are carried out in normal subjects and in patients with various disease states. Specifically, NIH-supported research in nutritional status includes research into the methods that measure nutrient concentrations; biochemical, anthropometric, and maturational indices of nutritional status; dietary recall; and food composition studies. Within the Federal Government, the NIH is the major agency for support of nutritional status research and for the development of data that are used in nutritional surveys.

Studies on nutritional status include the following: epidemiological

studies; psychometric studies measuring IQ, infant development, and behavioral changes; neurometric studies of visual or auditory stimulated responses in the brain as measured by electroencephalogram; metabolic balance studies such as endocrine calcium-sodium balance studies; studies of iodine deficiency and the incidence of goiter; and isotope studies that track the metabolism of glucose, amino acids, and fatty acids through the body, particularly in patients receiving total parenteral nutrition. Enzymatic methods for determining adipose tissue markers and body fat content, radiolabeled antibody methods for measuring serum-ferritin in iron storage disease, radioimmunoassays for measuring vitamin A, methods for rapid assessment of pantothenic acid status, new laboratory methods for discovering inborn errors of metabolism, and mathematical models for glucose production rates are also being examined.

A large amount of NIH-supported research is concerned with measurements of nutritional status in normal adults, as well as in infants and children. Studies on the requirements for essential nutrients include studies on trace mineral requirements for zinc, chromium, silicon, and fluorine. A number of projects deal with improving methods for determining vitamin status under varying conditions in infants, children, and pregnant women. Clinical measures to determine vitamin D status in infants, vitamin B_6 needs in pregnancy, and other vitamin needs in long term users of oral contraceptive agents are being examined.

A special group of studies focuses on the nutritional status of pregnant women in order to prevent congenital abnormalities that may result from nutrient deficiencies of the mother during pregnancy, and to permit optimum physical and mental development of infants and children.

Methods of measuring body fat content in human subjects are being comparatively studied at the obesity centers, while other studies compare the hemoglobin levels in blacks and whites in order to determine true normal hemoglobin levels. Several other projects are related to methodologies for determining tissue components used in nutritional status measurements. Specific examples include metabolic studies on protein and specific amino acids, trace minerals like selenium and iron, and studies on certain vitamins such as folate and pantothenic acid. Human hair is being analyzed for use in fetal-maternal nutritional status assessment.

Because the elderly tend to have more diseases and illnesses, the NIH supports research specifically aimed toward assessing the nutritional status of the aged. For example, one study in this area aims to determine whether increases in adipose tissue and decreases in lean body mass are fundamental to the aging process and whether restricted feeding would slow or prevent such changes. The NIH is also funding a study to evaluate the effect of supplemental zinc on several parameters of health status and taste acuity in a group of normal, aging women.

Research in nutritional status also includes various animal models. One investigation is attempting to determine the levels of a number of trace elements in tissues of the rat throughout its entire entire lifespan.

Zinc, copper, magnesium, calcium, selenium, manganese, and various enzymes related to these substances will be assayed in brain, liver, kidney, heart, and muscle. The changes in these parameters with aging will be studied and compared in both normally fed and underfed animals. In primates, various dietary patterns and their relationship to exploratory behaviors and habituation are also being studied. Another animal study is obtaining information on the effects on life-span of various aspects of mealfeeding, especially the timing of meal consumption in relation to daily light-dark cycles. The study will also provide data on how within-day timing of food intake influences metabolic patterns and thereby produces variation in circadian rhythms.

The NIH, particularly NHLBI, has several programs such as the Lipid Research Clinics Program, the Multiple Risk Factor Intervention Study, SCOR Projects and other investigator-initiated research projects that include the assessment of nutrient intake or the establishment of specific dietary regimens for planning research diets. For these projects, data on food composition are needed that accurately reflect the nutrients found in todays food supply. To assure the availability of the most current and valid food composition data, the NHLBI has two reimbursable agreements with the U.S. Department of Agriculture; one with the Consumer and Food Economics Institute and the second with the Nutrient Composition Laboratory. Current clinical trials and epidemiological studies have provided the opportunity to develop, test and refine methods for measuring nutrient intake in populations based on the best available food composition data. The aim of this activity is to yield standardized measurement methods.

In addition to research in nutritional status of normal individuals throughout the life cycle as described in preceding paragraphs, the NIH supports considerable research concerned with the nutritional assessment of persons with various diseases and conditions.

One important area of concern to NIH is the nutritional assessment of patients with cancer. The overall research objectives are: 1) to evaluate the safety and acceptability of assessment techniques for normal controls and for patients with cancer; 2) to determine if the techniques are applicable in the field and in clinical settings; 3) to determine the mean values and ranges both for normals and for patients with cancer; 4) to follow prospectively possible changes in body composition in patients with cancer; and 5) to determine if optimal enteral or parenteral alimentation can maintain or reconstitute body composition of patients with cancer who are undergoing treatment. In order to achieve these objectives, studies include a wide spectrum of techniques with core data collected on anthropometric measurements, biochemical analyses, hematologic tests, urinalysis, skin fold tests, and diet diaries. One study is evaluating the effectiveness of three different nursing interventions on food intake patterns, and nutrition and health status of cancer patients. A system to assess the nutritional status of the malnourished or potentially malnourished cancer patient will be developed in order to help physicians and/or dietitians prescribe the appropriate nutrition intervention.

Methods to measure nutritional status of cancer patients include improving the tools to measure specific body pools and body tissue. Studies include in vivo quantification of body nitrogen by whole body neutron activation as an estimate of total body protein; estimating total body water and extracellular fluid volume through the use of whole body impedance; determining body volume and surface area through biostereometrics - a technique that involves the translation of information provided by simultaneous photographs into a form that can be accepted and analyzed by computer; measuring adipose, musculoskeletal, cardiac and visceral tissue for assessment of protein calorie malnutrition; and determining body composition in patients with neoplasia by ultrasound techniques. Protocols are being developed for the use of ultrasonic measurements in clinical investigations. Immunological techniques are being evaluated for assessing the nutritional status of children with or without cancer both in the field and in clinical settings.

Additional NIH-supported research will develop new, more reliable, and more acceptable methods for the nutritional assessment of patients with cancer. The development, validation, and standardization of appropriate methods are essential if the effects of various nutritional support and treatment protocols on the nutritional status of patients are to be determined.

Another important area in nutritional status research is concerned with persons at high risk of coronary and vascular diseases and the role of diet in lipoprotein levels, including HDL. Several major projects underway include: The Stanford Five County Heart Disease Prevention Study, that involves five California communities with populations between 34,000 and 85,000, aims to bring about change in individual behavior and thereby decrease mortality and morbidity from coronary heart disease. Diet is an important component of this health education intervention program. Independent samples of approximately 1,000 participants are assessed annually to determine changes in knowledge, behavior, and physiology.

The Research and Deomonstration Center for Health and Vascular Disease conducts basic and clinical research and develops treatment protocols for heart and vascular disease including a focus of community efforts. A portion of the program involves assessment of lipid levels during the dietary intervention.

The Multiple Risk Factor Intervention Trial tests whether intervention in a group of 12,000 men 35 to 57 years old, who are at above-average risk of death from coronary disease, can yield a 50 percent reduction in mortality from coronary heart disease. The intervention component of this trial is designed to bring about changes in eating habits to achieve a reduction in serum cholesterol. Particularly important to this study is simultaneous evaluation of several risk factors. The methodology for assessment of dietary intake is standardized with those used in the Lipid Research Clinic (LRC) studies to facilitate comparison of the results.

The Lipid Research Clinic program has two projects of importance to

nutritional status research: the Prevalence Study and the Coronary Primary Prevention Trial. The Prevalence Study, involving 10 clinics, is an internationally based study of the prevalence of dyslipidemias in defined populations. This large-scale, multi-center collaborative population study uses comparable methodology to enhance detection of dietary influences on lipid transport diseases. The Coronary Primary Prevention Trial involves more than 3,800 men between 35 to 54 years of age and tests whether lowering cholesterol in hypercholesterolemic men will reduce or slow the development of premature coronary heart disease; the nutrition objectives are to achieve moderate long-term dietary intervention in patients taking cholesterol-lowering drugs, to assess the pre-study diet, and to evaluate group changes in dietary intake after counseling.

Another area of research on nutritional status is a large group of studies related to parenteral nutrition, with emphasis on the requirements for fatty acids, protein, amino acids, trace elements, and other micronutrients. These studies are intended to develop complete chemically defined mixtures for use in parenteral feeding. Metabolic studies of parenteral nutrition in infants are also underway.

Various other studies include a miscellany of research. For example, the use of red blood cell "ghosts" for delivery of iron chelators to sites of iron storage in order to diagnose and follow-up of patients with iron storage disease is being investigated. A study on patients with phenylketonuria seeks to assess learning ability and motor performance. The feasibility of using selected immunologic tests as a correlate of malnutrition in patients with hypercatabolic illness is another study. Another area is concerned with research on nitrogen balance in surgical patients and on the role of host defense mechanisms in the control of surgical infection under various dietary intakes.

NUTRITION AND AGING

The Division and Institutes supporting research in FY 1980 on nutrition in aging are DRR, NCI, NEI, NHLBI, NIA, and NIAMDD in the amount of $8.2 million or 6 percent of total nutrition research.

Heredity establishes the foundation for the body's ability to cope with the psychophysiological changes that occur with aging, but good nutrition may in fact make the foundation stronger and more resistant to such changes. A major question for scientists today is whether nutritional needs change significantly after the first fifty years of life; and if so, how do these needs change and what specific nutrients are involved? Both laboratory and clinical studies examine the effect of aging on the need for vitamins, mineral metabolism and taste acuity, biochemical changes in the brain, protein or amino acid metabolism and bone density, as well as fat metabolism and atherosclerosis.

As people age, the maintenance of health and prevention of disease is more of a problem. Cancer, atherosclerosis, coronary artery disease, hypertension, blindness, etc. more often affect the elderly than the

young. Obesity in the elderly may also be related to late onset diabetes, and diseases of the joints.

The incidence of tumors observed in old age is very high. The metabolic parameters studied in experimental animals that might contribute to this phenomenon include: body weight and body composition; efficiency of energy utilization; and maintenance requirements. Research is also underway to ascertain whether any biochemical change in the cellular metabolism of chemical carcinogens can be correlated with an increased vulnerability to cancer. The question as to whether or not age increases this vulnerability by preventing the conversion of carcinogens by the liver to their less carcinogenic metabolites is being studied.

It is thought that dietary restriction initiated in adulthood may inhibit spontaneous carcinogenesis by its effect on the immune system. Age sensitive immune indices such as lymphocyte proliferation, humoral immune response, and lymphocyte toxicity are being studied to determine the effect of diet on the aging immunologic suppressor response.

One of the major causes of blindness in the U.S. is senile macular degeneration, a degenerative change in the retinal pigment epithelium (RPE) that comes with age and the accumulation of lipofuscin. Studies include an evaluation of the effect of Vitamin E on RPE and the experimental modification of the lipofuscin content of RPE cells. Lipofuscin is now thought to possibly represent the indigestible residue of cellular phagocytosis and autophagy that can be reduced or have its formation suppressed by antioxidants and pigment mobilization drugs. The exact relationship of lipofuscin accumulation to the functional capacity during senescence is not known, but an association has been suggested.

The Prevalence Study of the Lipid Research Clinics includes individuals up to age 100 who have gone through a series of two screening visits to determine their plasma levels of low density lipoprotein (LDL) cholesterol and triglycerides. The study has shown that levels were lower in individuals over 70 years of age than in those between 60 and 70 years of age. This difference was not evident for levels of high density lipoprotein and cholesterol.

The development of atherosclerosis and its relationship to lipid levels, and hypertension, etc. are common concerns in geriatric research along with sulfur/amino acid metabolism, bone density and the development of osteoporosis.

Many of the Clinical Nutrition Research Units contain a geriatrics program component which provides training for professional career students in the field of geriatrics, as well as nutritional support services for the geriatrics patient.

CHILD AND INFANT NUTRITION

Research on the role of nutrition in maintaining the health of infants

and children is a very important part of the nutrition program at NIH. In FY 1980, $22.8 million or 16.4 percent of total nutritional research was spent by DRR, NCI, NHLBI, NIAID, NIAMDD, NICHD, NIDR, NIEHS, and NINCDS.

Every child born is a product of his or her genetic background that must bear the environmental influences of our time. Nutrition is one factor that plays a major role in the proper growth and development of infants and children. Women in the childbearing years are advised to maintain adequate body stores of vitamins and minerals so that their body is ready to handle the additional demand for nutrients that comes with pregnancy and lactation. And in recent years, attempts to determine specific demands and to uncover the possible role of nutrition before and immediately after birth have led to exploring the environment of the fetus and the neonate.

In order to understand growth and development throughout the life cycle, research studies are underway to more fully explain the interactive role of the various nutrients in relation to early stages of growth and development. Metabolic capacity and the development of fat absorption is being studied in the neonate, while the mechanisms of enzyme production and neural tissue development, and the correlates of adipose cell growth and the regulation of appetite are being studied in the infant. The study of hereditary metabolic disorders of amino acids, organic acids and related compounds, particularly those causing mental retardation and other neurological and metabolic abnormalities, includes the following specific disorders: hyperornithinemic syndromes, the sulfur amino acid disorders of sulfite oxidase deficiency, and beta mercaptolactate cysteine disulfiduria, hyperphenylalaninemia, maternal phenylketonuria and non-ketotic hyperglycinemia. These studies will attempt to identify the enzyme defects and unknown metabolites, to develop the procedures for neonatal and prenatal diagnosis, to uncover the relationship between biochemical defects of the mother to abnormality in the infant, and to evaluate the biochemical and chemical effect of dietary therapy.

Studies are underway to investigate the nutrient requirements of premature, normal and growth retarded infants. The requirements for protein, energy, vitamins and minerals in the premature low birth weight infant need to be established in order to develop an appropriate nutritional therapy that allows for an acceptable rate of extra-uterine growth and development. The specific requirements for the essential amino acids for premature infants differ from those of full term infants due to the enzymological immaturity of various synthetic pathways in these infants. Research has shown that tyrosine, arginine, cysteine and cystine, as well as taurine and histidine are essential for premature infants in addition to the eight essential amino acids needed by adults. The protein requirement for premature infants is also currently under investigation. Research in the nutrient requirements of normal term infants at birth and during the first year of life entails metabolic balance studies to establish the requirements for protein and energy, essential fatty acids, vitamin D, iron, zinc, and other trace metals.

Studies continue on the physical and mental development of infants with various kinds of malnutrition, that include protein-calorie malnutrition, deficiencies of specific nutrients, or malnutrition brought about by inborn errors of metabolism. Malnutrition, in terms of pre and postnatal undernutrition, and its effect on mental development and behavior has been a research interest for a number of years. Undernutrition often occurs in various disease conditions or along with the inborn errors of metabolism such as phenylketonuria, galactosemia, and homocystinuria.

Some of the specific areas of study in infants and children include energy relationships in inborn errors of metabolism, behavioral precursors in infant obesity, early nutrition and the development of obesity, inherited abnormalities of iron, copper and hemoglobin metabolism, the use of safflower oil in the treatment of essential fatty acid deficiencies in children, and the use of keto acid and amino acid mixtures as effective treatment to children with certain inherited metabolic defects of the urea cycle.

The effects of malnutrition are often compounded when an infant or child is exposed to a microbial pathogen and develops diarrhea. Studies are underway to examine the effect of specific enteric microbial pathogens on intestinal function and absorption of nutrients, as well as to examine the immune response of newborns to ingested antigens, the diagnosis and mechanisms of food allergies, and the effect of trace elements on leukocyte function. Deficiencies in protein and calories, vitamin A, and iron are specifically related to a decline in the immune response in children. In an attempt to treat these nutrient deficiencies, various oral rehydration formulations have been compared and therapeutically tested.

Research to identify and isolate undefined components of colostrum and human milk, (which may include hormones, enzymes, growth factors, etc;) as well as possible contaminants is given high priority. The most important discovery has been the role of breast milk in developing immunity against specific antigens in the breast-fed infant. Breast milk has been found to contain the antibody, secretory IgA, which is particularly important in protecting the infant against the intestinal infection that often leads to severe undernutrition, as well as antibodies against food proteins. These antibodies reduce the risk of food allergies in infants who are prone to developing them. Also present in breast milk are viable macrophages, T lymphocytes and B lymphocytes that may play a role in neutralizing the effects of viruses, bacteria, bacterial toxins and other foreign antigens. Additional studies have shown that human milk contains high concentrations of lysozyme and lactoferrin, two soluble proteins that inhibit bacterial growth in the gastrointestinal tract of human newborns. Lysozyme is involved in the lysis of bacteria, while lactoferrin binds the iron required for bacterial growth.

Laboratory evidence indicates that the biochemical, nutritional, immunologic and anti-allergenic properties of breast milk contribute to improved nutrition, and health and survival of infants. As a result, information is being collected on methods of collecting, storing, processing, and distributing human milk and colostrum through a Human Milk

Bank Research Distribution Center. Research has shown that storing and processing the milk in pyrex rather then polyethylene containers preserves more of the viable population of immunologically active cells. Techniques are being developed to combat viral contamination with cytomegalovirus or hepatitis B virus without destroying the immunologically active cells or denaturing proteins that possess antimicrobial activity. Such a center may ameliorate many of the causes of morbidity and mortality in the normal infant, low birth weight infant, and premature infant.

Assessing the transmission of other environmental agents from mother to child is also an important priority with projects exploring the pharmacokinetics and toxicity of these agents in offspring exposed during the perinatal period.

Research projects are studying the possible nutrition-related risk factors in infants, children, and adolescents that may play a role in hypertension, arteriosclerosis, juvenile onset diabetes, cancer, and dental caries. The Specialized Center of Research (SCOR) in arteriosclerosis focuses on anthropometric parameters, blood pressure, serum lipids and lipoproteins, smoking, and blood glucose levels as possible risk factors for arteriosclerosis in children. The habitual salt intake in school children is being assessed, and the correlation of urinary electrolytes with blood pressure is being determined. Dental caries is a major public health problem in children; consequently factors, particularly vitamin A deficiency, that may affect abnormal tooth development and thereby increase caries susceptibility are being examined.

The Diet, Nutrition, and Cancer Program includes pediatric cancer patients in an effort to provide and evaluate total parenteral nutrition as an adjunct to therapy. Studies are underway on the possible relationship between lactate production and tumor growth, and on the metabolic response of severly debilitated patients to nutritional supplementation by short-term intravenous hyperalimentation. A prospective study will evaluate the benefits and complications of various modes of nutritional support in children receiving multimodal treatment for stages II - IV Wilms' tumors. The effectiveness of various screening procedures to detect those children prone to developing cancer is also being evaluated.

Finally, the Clinical Nutrition Research Units include research directed toward the nutritional needs of infants and young children. A number of studies are looking at various effects of total parenteral nutrition in infants and young children, in terms of the effect of amino acid infusions, particularly cysteine and taurine, on plasma amino acid levels; the effect of the quantity and source of calories on nitrogen balance; and hepatic dysfunction during TPN. Additional research considers the effect of medium chain triglycerides (mct) and taurine in healthy, low birth weight infants; the net amino acid balance in different forms of renal acidosis in infants and children; the effect of breast-feeding on immune response; the effects of the nutritional status of the mother on fetal growth and placental growth and function; the effect of various amounts of protein and energy on the growth and metabolism of full-term infants; the effect of chronic dialysis on vitamin/trace mineral homeostasis in

children; the use of 1-25 dihydroxyvitamin D_3 in steroid induced osteopenia; and the alterations in lipid metabolism in cystic fibrosis.

MATERNAL NUTRITION

In FY 1980, research on maternal nutrition as supported by DRR, NHLBI, NIA, NIAMDD, NICHD, NIDR, and NINCDS totaled $5.5 million, or 3.9 percent of total nutrition research at NIH. It is now an accepted tenet that the nutritional status of the mother affects not only the growth and development of the child, but her own health as well. Many of the related nutritional questions, however, remain unanswered and many problems remain to be solved.

Studies with an emphasis on the relationship of nutrition to reproduction attempt to analyze the effects of vitamins on reproductive function and morphology, the consequences of malnutrition on reproduction and lactational amenorrhea, the relationship between oral contraceptive use and vitamin metabolism, the role of nutrition in population dynamics, and the establishment of maternal nutritional requirements during pregnancy and lactation that assure optimal growth and functional development of the fetus and newborn.

Longitudinal studies are underway in an attempt to relate maternal nutrient intake to fetal outcome and to subsequent infant growth and development. The requirements for energy, protein, certain vitamins and trace elements during pregnancy are being examined both in human and animal models. The assessment of nutritional status in women before and during pregnancy is an important research area, as the differential pattern of weight gain during pregnancy in terms of fat tissue, muscle mass, breast, placental and uterine tissue, may influence the course of pregnancy and fetal development.

The goal of a large research program in maternal-fetal nutrition is to achieve a better understanding of the complex relationship that exists between the mother and her fetus and the means by which nutrients pass from one to the other. This research focuses on efforts to predict the nutritional status of the fetus through the examination of various factors in the mother's blood; on the elucidation of the mechanisms of placental transfer by which glucose, amino acids, vitamins, zinc, calcium and other essential nutrients are transported in proper amounts from mother to fetus; and on the effects of excessive or deficient amounts of certain nutrients on the morphology and endocrine development of the fetus.

In addition, emphasis is placed on fetal development in nutritionally or metabolically compromised pregnancies as well as on elucidating predictors of intrauterine growth retardation (IUGR), assessment of the mental development of growth retarded infants and exploring the appropriate nutritional intervention to potentiate their mental and physical development. The etiology of IUGR appears to be multifactorial in nature involving not only maternal nutritional status and maternal nutrient intake during pregnancy, but also placental circulation and

nutrient transfer, maternal smoking habits and socioeconomic status, and perhaps maternal-fetal immunological incompatibility. Investigators have recently developed ovine models of IUGR, produced by experimentally induced placental insufficiency as well as by maternal dietary restriction, that are being used to study the differences in fetal body composition and the feasibility of intrauterine nutritional therapy delivered directly to the fetus by way of the amniotic fluid.

Other conditions that often are associated with pregnancy or lead to complications in pregnancy include toxemia, hypertension, obesity, eclampsia, diabetes, and renal disease. Efforts are being made to learn how to manage the nutritional needs of a normal pregnancy as well as gestation complicated by hypertension and renal disease, obesity, diabetes, and deficiencies in nutrients such as folate or iron. Folate deficiency in pregnant women has been associated with spontaneous abortion, toxemia, premature deliveries, and fetal abnormalities. Research is underway also on abnormal tooth development and increased susceptibility to dental caries under various vitamin A deficiency conditions, palate development in folate deficiency, and the metabolism of fluorides in the mineralization process.

In a number of animal studies, investigators are looking at the effects of essential fatty acid deficiency, saturated fatty acids, trans fatty acids, and cholesterol on growth and lipid metabolism in the developing rat brain; the effects of marginal levels of Vitamin B_6 given to dams during growth, pregnancy and lactation on the cortical thickness, cell packing densities, dendritic elaborations, spine densities and myelination patterns in the central nervous systems of the young; and the effects of prenatal copper supplementation in a rat model for Menkes kinky hair syndrome on the copper distribution in various organs.

TOTAL PARENTERAL AND ENTERAL NUTRITION

The NIH supports and conducts research and training in various aspects of total parenteral nutrition (TPN). The DRR, NCI, NIA, NIAID, NIAMDD, NICHD, and NIGMS support research in this area. In addition to extramural support the NCI also supports studies in TPN in its intramural program. Training in TPN is supported by NIAMDD and NIGMS. Total research obligations in the extramural program totalled $5.7 million for FY 1980 or 4.1 percent of total nutrition research.

The extramural research support includes studies on the determination of nutritional requirements of patients that receive hyperalimentation, as well as studies on the methodology to define precisely the nutritional status of patients. Such studies are carried out in low-birth-weight infants, in children hospitalized because of trauma and burns, in patients with cancer and gastrointestinal disorders, or who have undergone surgery, and in the elderly. Because many patients receiving hyperalimentation seem to develop lesions consistent with Candida endophthalmitis without changes in the serology or positive blood cultures, studies are in progress to examine the serum for candida products, and the significance of

these lesions in relation to infections other than Candida infections, hyperalimentation intravenous fluids or hypotension.

A study on new concepts in parenteral protein sparing therapy investigates: 1) the metabolism involved in the preservation of body cell mass using near isotonic infusions of amino acids; 2) the factors that influence the retention of these infused amino acids; 3) measurement of the dynamics of both whole body and visceral protein metabolism; and 4) the effect of amino acid therapy on survival. An additional study is on the effect of nutritional support on immune function and resistance to infection in patients with hypercatabolic illnesses.

A major thrust of the research is directed toward the elucidation of metabolic and pathophysiologic mechanisms associated with the hypermetabolic response to burn and traumatic injury; the development and application of quantitative methods for evaluating the effects of hyperalimentation in undernourished cancer patients; and the determination of the effects of hyperalimentation upon tumor response, duration of response, survival, tolerance to therapy, and weight change.

A major study on the effect of TPN as an adjunct to chemotherapy and prophylactic irradiation in patients with small-cell anaplastic carcinoma of the lung is underway. It seeks to determine the potential of TPN to improve clinical response to treatment, decrease treatment related toxicity, and improve patient survival. Another study is analyzing glucose and lactate metabolism in patients with solid malignant tumors in the colon in order to determine if lactate production is related to tumor growth.

Randomized clinical studies are designed to test the hypothesis that the administration of TPN is more effective than normal hospital regimens in maintaining adequate nutritional status and that it does not adversely affect tumor control. Other questions to be investigated include the effectiveness of TPN in maintaining the immune response and thereby lessening or moderating the complications associated with cancer radiotherapy, and whether TPN will actually result in a high success rate from total planned therapy. One cooperative clinical study is evaluating patients with a variety of cancer types of the abdomen and pelvis treated with high dosage radiotherapy. Another study compares regular oral diets with TPN by looking at the effects of TPN on the immunocompetence status in children receiving chemotherapy and pelvic irradiation.

In addition, the first prospective randomized trials of the use of TPN as an adjunct to radiation, surgery, and aggressive chemotherapy are in progress. The research includes prospective studies of the effect of TPN on the treatment of stages II - IV Wilms' Tumor in children, metastic sarcomas in adolescents, diffuse histiocytic lymphoma in adults, and patients with esophageal cancer. Another study examines optimal nutritional support as an adjunct to cancer therapy in the adult. The study, which involves a number of institutions, is examining optimal nutritional support of adults with testicular carcinoma and adenocarcinoma to determine its effects on tumor growth, tolerance to antineoplastic therapy,

and host tumor response, and to evaluate its safety and efficacy in maintaining the nutritional status of cancer patients and improving the quality of life. All patients under study are on an active cancer therapy program, including surgery, radiotherapy, and chemotherapy.

Other research workers are investigating the optimal intravenous feeding of surgical patients by assessing the effects of specific intravenously administered fluid regimens using combinations of amino acids, glucose, and fat. The effects of different intravenous regimens on specific protein synthesis are being assessed by using the highly specialized sodium ^{14}C carbonate technique to study the rate of albumin synthesis by the liver. In addition, hormonal (insulin and glucagon) and intermediary metabolic (glucose, ketone bodies, free fatty acids, plasma and varying amino acid concentrations, apparent and standard nitrogen balances) factors are also being measured in order to assess the effects of the different intravenous diets on interactions of hormones and intermediary metabolism interactions. Other studies seek to determine intravenous requirements for micronutrients (i.e., the levels of vitamins and trace minerals that must be present in TPN infusion fluids to maintain homeostasis in man).

In premature infants, research is progressing on parenteral requirements for amino acids and on the effect of the quanitity and kind of energy source on nitrogen retention. Related projects address the problem of newborn hyperglycemia induced by parenteral therapy, as well as the metabolism of intravenously administered lipid emulsions. Other research involves the study of various metabolic markers, such as 3-methylhistidine, in the urine of diseased newborn infants in order to establish the rate of administeration of parenteral alimentation, and the effects of parenterally administered vitamin E on preventing or modifying the course of bronchopulmonary dysplasia.

Three Clinical Nutrition Research Units include components with primary research emphasis on total parenteral and enteral nutritional support of patients. Some of these studies include investigations on hepatic function during TPN; metabolism of vitamins A, E, C and pyridoxine in patients with essential fatty acid deficiency; the metabolic fate of fat emulsions given to infants; the assessment of nutritional status in patients receiving TPN; and amino acid and nitrogen balance in children receiving varied amounts of protein and calories.

NUTRITION EDUCATION FOR THE PUBLIC

Although the primary mission in nutrition of the NIH is the support of biomedical and behavioral nutrition research and training, nutrition education for the public is an integral part of many programs. Total obligation for FY 1980 was $3.2 million or 2.3 percent of total nutrition research. Two Institutes have specific mandates for information and education programs: the NCI and the NHLBI. Nutrition education for the public is also provided through programs funded by the DRR, NIAID, NIAMDD, NICHD, NIDR, and the NCC Office. Efforts are continually made

to translate the results of nutrition research into practical information for the American public. The aim of this nutrition education effort is to help the public select a healthy diet suitable to individual needs throughout the life cycle.

Information is disseminated through a variety of mechanisms. Publications dealing specifically with nutrition are available through the NIH. Public racks in almost 3,000 supermarkets, drug stores, and department stores are stocked with a selection of NIH publications. In addition, the "Search for Health" news column is sent to over 500 daily and small-town newspapers on a weekly basis. A collection of articles about NIH research developments is contained in the publication NIH News and Features; from 8 to 10 percent of the content concerns nutrition. A number of nutrition Public Service Announcements (PSA's) on both radio and television have been developed by NIH and are being distributed widely.

Another means of providing nutrition education to the public is through the NIH lecture series, "Medicine for the Layman," which is now in its fourth year. In FY 1980, the series included a lecture on cholesterol and heart disease. The series is videotaped for possible use on public television.

The newest addition to the support for nutrition education for the public falls under the auspices of the National Program in Clinical Nutrition Research based on the Clinical Nutrition Research Units (CNRU). The overall CNRU program is described in detail on pages 9-11. Education programs for the public are an integral part of each of the seven CNRU's funded since FY 1979. One of the three objectives of the CNRU program is to "enhance patient care and promote good health by focusing attention on clinical nutrition and generating nutritional information for the public." Five of the CNRU's are funded by NIAMDD and two by the NCI.

Nutrition education and information programs are integrated into 13 clinical cancer education programs initiated in response to the rising interest of the lay public in the role of diet and nutrition in cancer etiology and prevention, as well as in the treatment and rehabilitation of the cancer patient. The NIH supports the education efforts of its regional cancer centers and provides technical support for the cancer telephone inquiry services of the American Cancer Society.

Education of the public is an important goal of the Diet, Nutrition and Cancer Program (DNCP). Beginning in FY 1979, in an effort to analyze the need and possibilities for nutrition education, the DNCP collected information to serve as a basis for the Dietary Guidelines released in 1980. In addition, the DNCP began the process of developing educational materials designed for primary, secondary, and college level curricula. The DNCP efforts to assist cancer patients through nutrition education included distributing two handbooks for cancer patients on nutrition and cancer therapy: Eating Hints: Recipes and Tips for Better Nutrition During Treatment, produced by the Yale Comprehensive Cancer Center; and Diet and Nutrition: A Resource for Parents of Children with Cancer, developed by the NCI and the Candlelighters.

A major contribution of NIH in nutrition education for the public are those education efforts designed to translate the results of fundamental research in heart disease into practical suggestions for all Americans. Good heart health through "prudent self-reliance" is especially important in nutrition, where choices of eating styles are both controversial and elective. Other recommendations offer practical behavioral advice on how to implement and sustain new health habits required for a more healthy life style.

A year long project, entitled Foods for Health, was initiated by NHLBI in FY 1978 with the cooperation of the Giant Food Corporation. The program provided heart health nutrition information and education in ninety supermarkets in Maryland, Virginia, and Washington, D.C. Through large in-store posters and free publications called "The Eater's Almanac," consumers were given information on the growing scientific evidence on the relationship between diet and coronary heart disease. The program goals were to inform consumers and encourage them to make personal risk assessments. The results from the Foods for Health Project show that over three million "Eater's Almanacs" were picked up by the shoppers in the supermarkets. The program's impact on the pattern of food purchases is described in detail on page 138 under the special interest area of Nutrition Education Research.

To date, the NHLBI has received 15,000 unsolicited inquiries about various aspects of the program from consumers, organizations, and health groups. Numerous organizations such as Hoffman-LaRoche and Michigan Blue Cross and Blue Shield have adopted the program materials and have already reprinted the Almanacs for their employees. The Department of Health and the Environment in Kansas and the College of Human Medicine, Michigan State University are planning to reprint and distribute the Almanacs. Requests about the availability of the negatives to reprint the "Eater's Almanacs" have been received from more than sixty organizations. The American Heart Association (AHA) has adapted the program and will "market" it through AHA's affiliate chapters throughout the country.

In April, 1980, U.S. Air Magazine with 1,400,000 readers per month, began publishing a twelve month series of one page articles on "heart healthy nutrition" that give advice on nutrition for hypertensives, low fat diets, etc. Other mass media campaigns are part of the National High Blood Pressure Education Program. Messages emphasizing a complete regimen of sodium restriction and weight control are presented through radio and television spots, and the print media. The NHLBI publication entitled Questions About Weight, Salt and High Blood Pressure explains to the public the current state of the art on the possible relationships between sodium intake, obesity and high blood pressure.

The program of the Research and Demonstration Center for Heart and Vascular Disease includes publications on heart health designed for the Spanish speaking populations in the greater Houston area and a cooperative program with Home Demonstration Clubs of the County Extension Service that attempts to change dietary habits especially in lower income blacks.

In both heart disease and cancer, targeted populations are being exposed to nutrition education materials for the maintenance of health or treatment of disease. These NIH nutrition education programs appear to be successful and indicate that people, given sound applicable information are in fact willing to change and improve their dietary habits.

Publication and dissemination of nutrition information is common practice for many Institutes at NIH. Two public education pamphlets, one on obesity and one on general nutrition are currently being put into final form. Attempts are made to answer the public demand for nutrition information by providing reprints, fact sheets, and publications on nutrition topics such as obesity and energy metabolism through the Information Offices and the NCC Office. In the print media, nutrition research information has been provided to a number of staff or free lance writers of popular magazines such as Good Housekeeping, Family Health, and Cosmopolitan.

A large campaign is devoted to informing and educating the public on ways of preventing tooth decay and other oral health problems. Publications devoted to healthy teeth through the development of good eating habits and preventive practices, such as the use of fluoride and good oral hygiene, are being distributed. One publication, entitled "Good Teeth for You and Your Baby", was prepared for expectant mothers and for mothers of young children. It emphasizes the "how to's" of good dental health habits for both mother and child. Neighborhood health clinics, supermarkets, childbirth and baby care classes, magazine advertisements, state and local health departments, and many other outlets have been used to distribute this publication, which was prepared in Spanish as well as English. Over half a million copies were distributed in the first six months following publication. Another leaflet on sugar in the development of dental caries is being developed for teenagers and should be available in FY 1981.

In conjunction with these publications, two Public Service Announcements (PSA) entitled "Magical Munching" and "Notes on Good Snacking" have been developed. The intended audience for the first television spot consists of children aged 6 to 10 years while the second is aimed at children aged 11 to 14 years. "Notes on Good Snacking" has been distributed to 750 television stations and has received extensive airplay, while "Magical Munching" will be released in FY 1981. A leaflet to complement the spots is also being developed and will be available upon request. Four additional PSAs entitled "I Love My Teeth" and developed for radio with the help of popular recording stars, The Spinners, Sister Sledge, Donna Fargo and Paul Williams, promote the use of nutritious, noncariogenic snack foods. These radio spots have been distributed to 4,000 radio stations across the country.

The DHHS-NIH Health Message Testing Service (HMTS) analyzes all PSA's and brochures, fliers and posters produced by DHHS that are a part of a major Departmental communication campaign, and other PSA's upon request. HMTS assesses the communication effectiveness of radio and television PSA's and can assist in determining message recall, comprehension, personal

relevance, and believability of test audiences, as well as help to identify strong and weak communication points in the message. HMTS, created in 1977, is administered by the Office of Cancer Communication, NCI; the National High Blood Pressure Education Program, NHLBI; the Office of Health Information and Health Promotion, DHHS; and the Office of the Assistant Secretary of Public Affairs, DHHS.

Publications aimed at particular audiences are produced by a number of Institutes. They range from nutrition publications that address the dietary needs of pregnant women and infants to publications that attempt to explain special dietary regimens for those persons with specific health problems. A pamphlet entitled Food Allergy is available to explain the allergenic reactions of those persons sensitive to certain foods.

A major accomplishment was the joint development by DHHS and USDA of the publication, Nutrition and Your Health, Dietary Guidelines for Americans, issued in March 1980. The NCC Office and many of the NIH Institutes had input in the development of several drafts of this publication. The seven dietary guidelines are based on the most recent scientific positions on such topics as dietary cholesterol and saturated fat, sodium, alcohol, calories, carbohydrates, and protein. The publication is available to the public in both English and Spanish from local state health departments, the Government Printing Office, and the appropriate offices of both DHHS and USDA.

In consultation with the NCC, a series of 26 four and one quarter minute video tapes and 1 thirty minute anthology, entitled "Eat Well, Be Well," was produced by Amram Nowak Associates under contract with Metropolitan Life Insurance Company. Each of the films presents, in a most practical and visually pleasing manner, the scientific state of the art and rationale behind the many aspects of the seven dietary guidelines. The "Eat Well, Be Well" series is one of the best examples of successful collaboration of government and industry. In March, 1981, the series was made available to 225 public television stations across the country.

Another service provided by all the Institutes and by the NCC is the handling of public inquiries, both by mail and telephone. Information specialists are available during working hours to answer any questions--lay or professional--not only on nutrition, but also on all research topics within the purview of the NIH. In addition, the NCC maintains a full-time office staff to provide support to the Committee and to serve as a focal point for nutrition information. The NCC Office responds to inquiries from the scientific community, the media, and the concerned public.

NUTRITION EDUCATION FOR PROFESSIONALS

Studies and programs of NCI, NHLBI, NIA, NIAMDD and NICHD involving nutrition education for professionals accounted for about 3.3 percent or $4.6 million of the NIH nutrition program for FY 1980. Two Institutes,

namely NCI and NHLBI, have specific mandates for providing education programs to professionals.

Nutrition education for professionals is provided by the NIH through various means. The latest developments in nutrition research are published in such medical and scientific journals as the Journal of the American Medical Association, The American Journal of Clinical Nutrition, The Journal of Pediatrics, The Journal of the National Cancer Institute, The Journal of Clinical Investigation, The New England Journal of Medicine, and many other journals.

The nutrition publications of the NIH for professionals include: The Dietary Management of Hyperlipoproteinemia - A Handbook for Physicians and Dietitians, (NIH publication No. 80-110). This ninety-five page publication on the proper control of diet and body weight to manage primary hyperlipoproteinemia is available to physicians, dietitians, and nurses upon a written request. A ten page supplement to the handbook, entitled Fact Sheet: Hyperlipoproteinemia (NIH publication No. 79734), describes cholesterol and triglyceride, defines hyperlipoproteinemia and the different types, tells how the condition is diagnosed and describes current methods of treatment. Guidelines for the use of sodium restriction and weight reduction are incorporated in A Statement on the Role of Dietary Management in Hypertension Control developed by the NHLBI National High Blood Pressure Education Program Coordinating Committee which should be useful to health professionals. The second edition of the publication, Nutrition and the Cancer Patient: An Annotated Bibliography of Patient and Professional Information and Education Materials has been prepared. A special supplement to "Feeding, Weight and Obesity Abstracts" entitled Sweeteners and Dental Caries evaluates available and potential sweeteners as sugar substitutes in the development of noncariogenic foods and beverages.

An extensive effort in professional education includes continuing education courses that are provided for paramedical personnel, medical students, nurses, residents, practicing physicians and research scientists. Courses range from basic principles of cancer biology to current methods of prevention, detection, diagnosis, treatment and rehabilitation. A pilot project on teaching nutrition to health professionals via a tele-communications systems is descibed on page... under Nutrition Education Research. In addition, education programs for professionals are an integral part of each of the seven CNRU's since one of the three objectives of the CNRU program is to "strengthen training environments in order to improve the education of the medical students, house staff, practicing physicians, and paramedical personnel in clinical nutrition. The overall CNRU program is described in detail on pages 9-11.

As part of the Multiple Risk Factor Intervention Trial, methods have been developed which aid nutritionists in the dietary management of hypercholesterolemia. One method, a "food scoring system," is based on a prediction of the effect of foods on raising or lowering levels of blood cholesterol. The other method, entitled "Food Record Rating," also uses a "food score system" to facilitate the nutritionists in their

assessment of dietary adherence.

The NIH also supported the ninth revision of The Recommended Dietary Allowances (RDA's), the report "Research Needs for Establishing Dietary Guidelines for the U.S. Population", and a manual on How To Use the RDA, prepared by the Food and Nutrition Board (FNB), National Research Council (NRC) of the National Academy of Science (NAS). A new contract between NIAMDD and FNB-NRC-NAS for the revision of the 1980 publication, Recommended Dietary Allowances (RDAs), was initiated in December 1979 to include two additional components, each of three years duration. The first component is to develop guidelines for appropriate uses of the RDAs by professionals and laymen. The second is to address the issue of diet and its health implications. The purpose of the two additional components is to develop guidelines of desirable levels of food sources of energy - carbohydrate, lipids and protein and other food components, and to assess the health implications of dietary intakes of these food components. (As of February, 1981 this contract was under revision to eliminate the second component.)

NIH sponsored workshops and conferences are an important mechanism for imparting nutrition education for professionals. In FY 1980, the NCI, NHLBI, NIAMDD, NICHD, and FIC sponsored such activities. In addition, Institutes provide funds to national and international professional organizations for their annual meetings.

The National Cancer Institute

Under the auspices of the Diet, Nutrition and Cancer Program (DNCP) the NCI supported the following five conferences relating nutrition and cancer.

A "Confererence on Esophageal and Prostatic Cancer In Blacks and Whites," was held on October 23, 1979 in Washington, D.C. in order to review the documented differences between blacks and whites in mortality and incidence rates of esophageal and prostatic cancer. The participants of the conference looked at the epidemiological data in terms of environmental factors such as nutrition, cultural background, tobacco and alcohol use, as well as the differences of endocrine metabolism in the two groups. If the differences are in fact real, steps will be taken to identify recognized or suggested factors that may account for these differences.

A "Workshop on Fat and Cancer" was held on December 10-12, 1979 in Bethesda, Md. in order to review the available scientific information on dietary fat in relation to the incidence of various types of cancer. The meeting identified gaps in current knowledge and developed recommendations on the needs and priorities for further research in this area.

Due to the increased awareness of the impact of malnutrition upon the end results in cancer therapy, a "Symposium on The Nutrition of the Cancer Patient" was held on January 10-11, 1980 at the Masur Auditorium, NIH in order to review the current state of the knowledge in the areas of anorexia, host/tumor metabolism, and nutritional support. Data was

presented from both basic research studies and recent clinical studies, specifically randomized controlled studies.

Under the auspice of the U.S.-Japan Cooperative Cancer Research Program and supported by a bilateral agreement, a "Seminar on Gastrointestinal Cancer" was held in Honolulu, Hawaii on March 3-6, 1980. The seminar focused efforts on the integration of knowledge, concepts, and methods through discussions on the multidisciplinary search for the etiology of stomach and colon cancer, the comparative oncology of the stomach and the colon, and the comprehensive search for carcinogens, promoters and inhibitors of these two major types of cancer. Some of the points raised include: the need to retest the hypothesis that meat consumption plays a role in colon cancer; the need for intervention studies using vitamins A, C, and E; and the need to consider the genetic influence on the occurrence of precursor lesions or other predisposing conditions such as possible carcinogens and promoters of carcinogens.

A "Workshop on Lipid Oxidation, Vitamin E, Selenium and Carcinogenesis" was held on September 15-16, 1980 in Bethesda, Md. to assess the state of-the-art of the research on the relationship of each of these substances in terms of the causation or inhibition of carcinogenesis. Papers were presented on the basic aspects of lipid peroxidation and oxidized lipids, the effects of vitamin E on metabolic systems, the effects of selenium on experimental carcinogenesis and on various aspects of metabolism, the biochemical mechanisms of selenium toxicity and its relationship to carcinogenesis, and the study in cell culture and in animals of the mechanisms for the activation and inactivation of carcinogens. The role of iron compounds, especially biological chelators (ADP-Fe and heme compounds), in generating free radicals from lipids, and the role of OH^- superoxide and hydrogen peroxide in forming reactive species was also presented. The participants prepared recommendations regarding future basic research needs in anticipation of possible intervention trials.

The National Heart, Lung, and Blood Institute

In FY 1980, the NHLBI funded two contracts for "Regional Workshops for Nutrition Counseling in Hyperlipidemia for Dietitians and Nutritionists." The purpose of the workshops is to enhance the nutrition counselor's interviewing and counseling skills as well as increase their knowledge of the prevention and treatment of hyperlipidemia. Emphasis is placed providing nutrition counselors with an opportunity to learn, practice, and apply the skills learned in the work setting. One important feature of this program of workshops for nutrition education and evaluation is that it extends over approximately nine months and includes efforts to increase the number of similar programs in the future. The design and implementation of the workshop is being evaluated along with the change in nutrition knowledge and counseling skills of those who attend. These short regional workshops are based on a workshop on nutrition counseling in hyperlipidemia funded previously by NHLBI. A publication entitled Model Workshop on Nutrition Counseling in Hyperlipidemia (NIH Publication No. 80-1666) has been prepared and is being distributed.

Another model workshop program, "Diffusion of Innovative Nutrition Counseling Skills," is a collaborative effort between NHLBI and the American Heart Association (AHA). The AHA's network of affiliates and chapters is used in part to distribute some of the more innovative dietary counseling methods. The two day workshops bring together applied nutritionists, local practicing physicians, and behavioral scientists in order to stimulate those nutrition counselors to improve their personal counseling skills in order to assist in the prevention or control of cardiovascular disease. The success of this program has stimulated the compilation of a counseling skills handbook for publication. The program is an example of utilizing minimal NHLBI funding (for the development of several counseling workbook topics and for workshop evaluation methods), together with AHA's professional communication network, to develop a program that will influence cardiovascular nutrition counseling at the regional and local levels. The local "spin-off" workshops will use methods and materials already developed and will be completely self-supported.

A "Symposium on Current Nutrition Issues in Hypertension" was supported by NHLBI at the 1980 annual meeting of the American Dietetic Association (ADA) held in Atlanta, Georgia on October 7, 1980. The objectives of the symposium were: 1) To increase the knowledge of dietitians concerning the role of nutrition in the prevention and treatment of hypertension; 2) to increase the knowledge of dietitians regarding issues that require further investigation, such as methods to assess sodium intake, effects of potassium and weight control on blood pressure, individual differences in sensitivity to sodium, and interactions of drugs and diet; 3) to clarify nutrition recommendations; 4) to promote efforts to apply sound nutrition practices to the prevention and treatment of hypertension; 5) to increase the knowledge of health practitioners concerning sensory and cultural aspects of sodium and potassium use, and the effects of food processing on these dietary constituents; and 6) to encourage the food industry to moderate its use of sodium. Papers from this symposium are being published in the Journal of the American Dietetic Association.

The National Institute of Arthritis, Metabolism, and Digestive Diseases

During FY 1980, the NIAMDD partially supported or jointly planned a number of conferences and workshops designed to provide nutrition information for health care research professionals.

A "Conference on Micronutrient Interactions: Vitamins, Minerals and Hazardous Elements," cosponsored by the New York Academy of Sciences and the Fogarty International Center, was held on February 20-22, 1980 in New York City, New York. The purpose of the conference was to assemble those scientists who have done research in micronutrient interactions to discuss specific interactions of vitamins, minerals, or hazardous elements in order to establish the need and value of continued research in the field. The conference proceedings will be published as Volume 355 of the New York Academy of Sciences' Annals.

"The Second International Symposium on Selenium in Biology and Medicine," partially funded by the Fogarty International Center, was held in Lubbock, Texas on May 13-16, 1980. The purpose of the symposium was to explore and discuss the most recent research findings and provide an update to the knowledge of selenium's role in biological functions. Some topics covered by the participants were: selenium biochemistry, especially the elucidation of glutathione peroxidase activity; metabolism of selenium in light of its biological activity, its role in protecting against peroxide damage, and its distribution in animal tissue; and specific implications of selenium in relation to cancer, aging, immunity, fertility and heavy metal toxicity.

A Steering Group for "A Workshop on Methods for Characterizing Obesity" met in Bethesda, Md. on June 9, 1980 to discuss a four stage approach to establishing a classification system for the study of heterogeneous groups of obese individuals. The four stages are: 1) A workshop would consider and identify those factors and methods useful to distinguishing one type of obesity from another; 2) the proposed methods and data collection would be applied to a diverse group of obese patients; 3) A second workshop would evaluate the results of stage 2 and recommend an appropriate classification of obesity states; and 4) multi-centered intervention trials would test the utility of the classification system for individualization of therapy. It is hoped that such an approach would establish a clinically practical classification of the obesity syndrome in order to provide a framework for a better evaluation of newer modalities of therapy and prevention.

A "Conference on Vitamin B_6 Methodology and Nutritional Status," partially funded by the Fogarty International Center, was held on June 29-July 2, 1980 in Oregon to review the current state of the art for measuring different forms of vitamin B_6 or pyridoxine. A new chromatographic method for separating out the various forms of pyridoxine was explained to encourage the use of this improved method for measuring pyridoxine levels in nutritional status surveys.

A "Workshop on The Effect of Nutrition on Human Growth and Development and Later Life and Health: Global Priority Issues," cosponsored by the U.S. and Japanese Malnutrition Panels of the U.S.-Japan Cooperative Medical Science Program was held in July 29 - 30, 1980 in Morioko, Japan. The proceedings will be published in both Japanese and English.

"The Western Hemisphere Nutrition Congress VI," partially supported by the Fogarty International Center, was held on August 10-14, 1980 in Los Angeles, California. The Congress was organized by the American Institute of Nutrition, the Department of Foods and Nutrition and the Council on Continuing Physicians Education of the American Medical Association, the Nutrition Society of Canada, the American Society for Clinical Nutrition, and the Sociedad Latinoamericana de Nutricion. The theme of the Congress was "Nutrition in the 1980's--The Constraints of Our Knowledge." Its objective was to provide a multidisciplinary forum for professionals working toward solutions of diverse problems related to nutrition and the food supply. Program participants analyzed the current state of

scientific knowledge, the methods used to determine the needs of individuals and populations, and the procedures for establishing national policies and priorities for nutrition intervention.

"The International Symposium on The Metabolic and Clinical Implications of Branched Chain Amino and Ketoacids" was held on November 14-17, 1980 at Kiawah Island, Charleston, South Carolina. Branched chain amino acids (valine, isolucine and leucine) and their nitrogen free analogues, the branched chain ketoacids, have been recognized for their clinical importance in a variety of disorders including the portal-systemic encephalopathy, chronic renal failure, and urea cycle enzyme defects. This symposium provided a forum for the presentation of recent rsearch concerning the regulation of the metabolic pathways of branched chain amino and keto acids, their effect on other metabolic processes in the cell and their potential uses as therapeutic agents in various disorders.

The National Institute of Child Health and Human Development

In FY 1980 the NICHD cosponsored the following workshop and conference: A workshop on "Nutrition of the Child: Maternal Nutritional Status and Fetal Outcome," cosponsored by USDA and held on October 24-26, 1979 in Houston, Texas, included discusssions of nutrient requirements during pregnancy; assessment of nutritional status during pregnancy; the relation of maternal nutrition to obstetrical complications, placental factors condititioning fetal nutrition and development; nutrition and fetal outcome; and the evaluation of intervention programs designed to influence newborn outcome. The proceedings of the workshop were published in the April 1981 issue of the American Journal of Clincal Nutrition.

The conference entitled "Food, Nutrition and Evolution," cosponsored by the International Organization for the Study of Human Development and held on May 5-8, 1980 in Campione, Italy, included discussions on the issue of food in the genesis of human variability. Interesting papers presenting the behavioral, social, and cultural perspectives included such issues as the history of plant and animal domestication, the biocultural influences on the genesis of food preferences, taste and food preferences in the weaning of mammals, the ontogeny of taste, and weaning practices in primitive people.

The Fogarty International Center

Many of the NIH Institutes and the Fogarty International Center often join together to support meetings, workshops, or conferences held in the United States or abroad related to international nutrition research questions. These conferences are described in detail in Appendix B, FY 1980 International Nutrition Research.

NUTRITION EDUCATION RESEARCH

Nutrition education research is a component of a number of intervention programs and clinical trials, the Clinical Nutrition Research Units, and

special projects carried out by NICHD. In FY 1980, the DRR, NCI, NHLBI, and NICHD spent $11.3 million or 8.1 percent of total nutrition research in this area. The NHLBI supports the following intervention programs: The Stanford Five County Heart Disease Prevention Program, the Minnesota Heart Program and the Pawtucket Heart Program. The Multiple Risk Factor Intervention Trial (MRFIT) and the Coronary Primary Prevention Trial are two major clinical trials that include nutrition education research, while the Minnesota Heart Project represents a broad based educational effort with dietary management as one focus to reduce hypertension and hypercholesterolemia.

In the Stanford Five County Heart Disease Prevention Study, dietary change is an important component of a "Media Intensive Health Education Intervention Program" designed to prevent coronary heart disease. The study, involving five California communities with populations between 34,000 and 85,000, aims to elicit individuals to change their behavior and thereby decrease mortality and morbidity from coronary heart disease. The intervention is directed at two of the communities by means of mass media and small group instruction to induce reduction in the dietary intakes of cholesterol, saturated fat, calories, and salt. The same means of intervention are used to induce cessation of smoking. The nutrition associated goals include lowering levels of plasma cholesterol, triglycerides, and low density lipoproteins; reducing high blood pressure; correcting obesity; and promoting physical activity. This study is based on a previous study of three California communities where persons exposed to mass media and face to face counseling showed a substantial and sustained <u>decrease</u> in the incidence of cardiovascular disease.

In the Multiple Risk Factor Intervention Trial (MRFIT), the intervention component is designed to bring about changes in eating habits to achieve a reduction in serum cholesterol in a group of 6,000 men in the Special Intervention (SI) group. The men, ages 35 to 57 years, are above the average risk of death from coronary disease because of some combination of elevated blood cholesterol, elevated blood pressure, and cigarette smoking. The dietary intervention program utilizes techniques and knowledge of group dynamics and behavior modification. The methods of dietary intake assessment are standardized with those used in the Lipid Research Clinic (LRC) studies in order to facilitate comparison of results. Particularly important in this trial are measuring dietary adherence and simultaneously evaluating the effects of intervention on several risk factors associated with death from coronary disease. Dietary adherence is being measured by a scoring system which has been tested for reliability and validity. This tool is not only useful for periodic assessment of dietary adherence, but is also used as an educational and self-assessment tool for participants. This method will eventually have widespread practical application outside this clinical trial.

Another clinical trial, the Coronary Primary Prevention Trial carried out by the Lipid Research Clinics (LRC) of NHLBI, tests whether lowering cholesterol in hypercholesterolemic, but otherwise healthy men between the ages of 35 to 54 years, will reduce or slow down the development of premature coronary heart disease. The nutritional objectives of this

trial are to achieve moderate, long-term dietary intervention in patients taking cholesterol lowering drugs and control groups, to assess the pre-study diet, and to evaluate group changes in dietary intake after counseling. An important component of this study is an Iowa based Food and Nutrition Resource Center that plans and coordinates nutrition workshops, the sharing of educational tools, methods and diet adherence activities, and produces a periodical newspaper that contains information and ideas from the various clinics.

The Chicago Heart Health Curriculum Program has as its goal the implementation and evaluation of a cardiovascular disease prevention program for sixth grade students in Chicago city schools. This health education program integrates a humanistic approach to knowledge acquisition, attitude formation, and behavior change in an attempt to increase heart health knowledge related to nutrition and other risk factors of cardiovascular disease, to develop positive attitudes about healthful living, and to encourage behaviors consistent with a healthy lifestyle. Teachers and parents also participate in training workshops and education programs that encourage environments conducive to a heart healthy lifestyle for the student. The aim of the program is to evaluate the relationship among knowledge, attitudes, and behaviors that are consistent with the development of the type of lifestyle that may enhance the prevention of cardiovascular disease.

The National High Blood Pressure Education Program aims to develop means of providing better management of high blood pressure through a collaborative effort with the private sector, other Federal agencies, and state health departments through the education of health professionals, patients, and consumers. Because of the role that salt and weight play in the genesis, management, and treatment of many forms of hypertension, efforts are directed toward reducing overweight and the control of sodium intake in patients with high blood pressure.

Research on ways to control hypertension also takes place at the work site. Three studies are looking at the effectiveness of different intervention techniques for hypertension control in the work setting as indicated by changes in employee health status at the end of a 24-30 month period. The intervention techniques studied include a general education program about high blood pressure, its consequences, and treatment; a detection program to identify those persons at risk of high blood pressure; and a specific education program that includes dietary counseling for those persons identified as being at risk.

Another program, the Dietary Intervention Study of Hypertension, consists of three centers cooperating in a clinical trial to assess the effectiveness of diet therapy (weight control and/or sodium restriction) as an adjunct to or substitute for drug therapy for hypertension.

In order to conduct basic and clinical research and to develop treatment protocols for heart and vascular disease through community efforts, the NHLBI supports the Baylor Research and Demonstration Center for Health and Vascular Disease. Most of the nutritional components of the program are

implemented through community outreach clinics by the Control and Demonstration Division. This division attempts to maintain cooperative efforts with local restaurants in order to advertise and include nutritious low cholesterol meals on their menus. In cooperation with the Home Demonstration Clubs of the County Extension Service and the Expanded Nutrition Program (ENP) dietary intervention programs have been underway to alter dietary habits particularly in the lower socioeconomic class blacks. Analysis of these intervention programs is currently underway.

Presently, nutrition education research efforts are focusing on dietary intervention programs for couples using the techniques of behavior modification, such as "cognitive ecology," and "modeling" that have been shown to be successful in achieving dietary changes. The success of these intervention techniques on changing dietary habits are based on serum lipid determinations taken at three, six, twenty-four, and thirty-six months after dietary intervention is begun. The Control and Demonstration Division also designed the Spanish version of the Heart-Health publications, such as the "Help Your Heart Eating Plan," for the Spanish speaking population in the greater Houston area.

The Foods for Health Project, conducted in cooperation with Giant Food Corporation, provided the public in ninety supermarkets with heart health nutrition information through in-store posters and free publications called "The Eater's Almanac." Consumers were given information on the growing scientific evidence of the relationship between diet and coronary heart disease. The program sought to evaluate the impact of this point-of-purchase information on the pattern of purchases. The evaluation of the program considers: 1) changes in reported knowledge of heart health and nutrition issues, and in reported use of food preparation methods as they relate to heart health; and 2) changes in the purchase of foods designated as lower in saturated fats, cholesterol and calories, and 3) changes in the purchase of alternative foods which are higher in saturated fats, cholesterol and calories. Consumer food selections were monitored by the computer assisted checkout system. Approximately forty food categories, representative of foods related to heart health, were observed. The Baltimore stores served as a comparison group for evaluating the program's effectiveness in Washington, D.C., Virginia, and other Maryland stores.

The shoppers' knowledge about the heart healthy foods, as measured by their ability to correctly identify the foods lower in cholesterol and saturated fats was significantly greater in the Washington, D.C. area. At the same time no parallel gains in knowledge were achieved by the control group in Baltimore. Consumer knowledge about the relationship of fat intake and cholesterol levels showed a significant gain in the Washington area and over 85 percent of those surveyed believed that diet is related to heart disease. It was found that for individuals making changes in food buying or eating habits, 66 percent stated that the Almanacs helped in making the decision.

A major objective of efforts in nutrition education research by NCI was to determine how much of the information obtained on diet and cancer can

be used to educate the general public, the medical practitioners, and the scientific community. Innovative methods to provide such useful information as dietary guidelines were pursued as well as special efforts to develop education materials on diet and nutrition for use in primary and secondary schools.

In the Clinical Nutrition Research Units throughout the country, research and patient care are combined with education in the form of community outreach programs and opportunities for medical professionals to study and receive practical experience in cancer and nutrition. Clinical centers help to bring the state-of-the-art research from the laboratory to the practicing physician and thus improve patient care.

For example, at the University of Wisconsin's Clinical Nutrition Research Unit, under the direction of Alfred E. Harper, Ph.D., investigations are being conducted on the effect of providing low income homemakers with materials on nutrition and the degree to which these homemakers then teach nutrition principles to their children. Another project is designed to determine the feasibility of training Indian paraprofessionals on the reservations how to educate obese and diabetic clients about nutrition. This project is also studying the attitudes of the paraprofessionals and their clients about major health problems, that include diabetes and obesity. Additional research projects are designed to evaluate the effectiveness of various in-service programs that contain basic nutrition information, an independent study course for school foodservice workers, and a series of films designed to teach nutrition to children in grades four to six.

The University of Chicago's Clinical Nutrition Research Unit, under the direction of Irwin H. Rosenberg, M.D., is supporting an outpatient research project on education strategies for children with juvenile diabetes in the hope of developing innovative teaching tools that can be adapted to each child's age and preferred learning mode. The education strategies understudy are individualized teaching, teaching children in groups, and teaching children by the trained lay person, i.e. the mother of the diabetic child. This approach to nutrition education is also being used for obese children with the effectiveness of early intervention being evaluated in terms of the course of the disorder.

The nutrition education research activities of NICHD include several projects. One project entitled "Nutrition Education Via Tele-Communications Satellite" is designed to compare the effectiveness of three methods of nutrition education for health professionals. The three methods are as follows: one group of students views videotapes and attends regular classroom discussion sessions; the second group views videotapes and interacts with the instructor in structured discussions via satellite; and the third group views the videotapes and participates in informal discussion sessions with off-campus resources in the community. Results students involved in the formal discussions with instructors in the classroom or via satellite, demonstrate similar learning and satisfaction with the learning experience, whereas those who viewed the video tapes but did not have access to the instructors were less satisfied.

In order to develop a home-based behavioral program for obese children one project is designed to ascertain whether eating behavior or exercise behavior should receive greater emphasis in a program for obese children. A second project is establishing management strategies for overweight children. Attempts are being made to establish a model curriculum for students in various health care disciplines who are involved in the care and education of overweight and obese children. In addition, the present dietary management strategies for children with Prader-Willi syndrome are being evaluated in order to establish more effective dietary strategies.

A project on the development of positive health behavior in preschoolers investigates the antecedents of positive and negative health behaviors early in childhood with the aim of producing an effective program of health education for preschool children that will have a lasting effect on adult health behavior. The research is structured like a prospective clinical trial with one group of children receiving nutrition education intervention twice a week when they are 3 and 4 years old while another matched control group does not. Educational intervention for the parents parallels that of the children. The health behavior of the children will be assessed yearly for four years to determine whether the educational intervention affected dietary knowledge and behavior. The baseline data on antecedents of health behavior is being used to design educational programs for the parents.

A study entitled "Infant Feeding Problems Today: Information for Nutrition Education," involves interviewing one hundred mothers of one year old infants to determine the mothers' exposure to nutrition information and its relationship to their feeding choices. Another project involves developing teaching materials for independent instruction on basic nutrition facts and testing the efficacy of such an educational package.

The DRR is supporting one project that attempts to determine whether placing nutrition education materials in supermarkets is an effective way to influence consumer knowledge about nutrition and to promote health by influencing buying habits.

RESEARCH ON VITAMINS

The NIH supports and conducts research on the various metabolic functions of all essential nutrients. One area of particular interest is research on the vitamins as supported by the NCI, NEI, NHLBI, NIA, NIAID, NIAMDD, NICHD, NIDR, and NINCDS. Research on the fat-soluble vitamins includes studies on vitamins A, D, E, and K, while research on the water-soluble vitamins includes studies on vitamin C (ascorbic acid), thiamin (B_1), riboflavin (B_2), niacin, pyridoxine (B_6), cobalamin (B_{12}), folic acid and panthothenic acid. Research in this special interest area totalled $19.7 million or 14.2 percent of total nutrition research at the NIH.

A large part of the cancer research supported by the DNCP and the DCCP

is devoted to the development of vitamin A or retinoid analogues, and to the tumor inhibiting effects of vitamin A and its analogues in cancer of the breast, liver, colon, bladder, pancreas, oral cavity, and epithelial tissue. Studies are investigating the effect of retinoids on the morphology and differentiation of epithelial cell membranes, the effect of topical carotenoid pigment on the inhibition of tumors induced by ultraviolet violet light, the development of squamous cell carcinoma in vitamin A deficiency, the effect of vitamin A on drug metabolism and the production of embryonic growth factor receptors on tumor cells, and the optimum time lag between carcinogenic induction in the mammary epithelial cells and the beginning of retinoid therapy.

Epidemiological studies on the relationship of vitamin A in the diets of Columbian citizens, Hawaiian ethnic groups, and Louisiana state residents and the incidence of lung and other cancers are underway. Another study is investigating oral administration of vitamin A and its absorption in persons with enteric microbial pathogens.

Deficiencies of vitamin A, in conjunction with iron deficiency, and protein-calorie malnutrition are being investigated in terms of the effect on decreased immune function. Vitamin A deficiency and protein calorie malnutrition is also known to bring on xerophthalmia, an important cause of blindness in children in some developing countries. Research is underway on the manner in which retinol or retinoic acids are bound, transported, and released by binding proteins of the blood to the pigment epithelium and photoreceptors of the retina, as well as on the role of vitamin A in the formation and functioning of the retina and the cornea, and in cataract formation. Other studies are investigating problems of the eye in terms of deficiencies of both vitamin A and vitamin E. The role of vitamin A in the differentiation of epithelial tissue in spermatogenesis, in fetal growth and development, and in the differentiation and development of teeth and bones, lung tissue, and glycophospholipids and glycoproteins are additional areas of investigation.

The antioxidant effects of vitamin E on photoreceptor function and on the phagocytosis of outer segments by pigment epithelium of the retina is under study, as well as the relationships of prematurity, vitamin E, and prostaglandins in retrolental fibroplasia. The lipofuscin content of retinal pigment epithelium is being modified by the presence of vitamin E. Research on vitamin E also includes studies on the effect of dietary vitamin E on the tumorigenicity of established tumor cell lines, the inhibitory effect of vitamin E and selenium on carcinogenesis in the presence of chlorine and chlorinated compounds, and the effect of vitamin E on glutathione in liver cell tissue. In a study on the effect of dietary substances on aging, two types of tocopherol and three different dietary fats are being administered to determine the optimum polyunsaturated/saturated fat ratios and vitamin E levels. A study of the interactions of the ozone as an air pollutant, dietary vitamin E, and various unsaturated fats will focus its examination on the lung as a target organ. Clinical studies are investigating the requirements for vitamin E and the relationship of vitamin E to essential fatty acid

requirements and prostaglandin synthesis in the premature infant. Also, the reducing potential of vitamin E appears beneficial in ameliorating the oxidative ravages in various kinds of hemolytic anemias.

Studies on the role of vitamin E in heart disease include: the effect of vitamin E on the pathogenesis of atherosclerosis in rabbits and guinea pigs; the mechanism of vitamin E action on platelet aggregation and release, and thereby, vitamin E's effect on the metabolism of the blood vessel wall in the diabetic and normal animal; the effect of large doses of vitamin E in hyperlipidemic individuals; and the effect of vitamin E on vitamin K utilization. Investigations continue on the role of vitamin E in modulating the immune response, the generation of free radicals in vitamin E deficiency, the interrelationship of vitamin E and selenium, and vitamin E, fatty acids, and membrane function.

The possible relationship between vitamin D deficiency and carcinogenesis has become an area of interest as suggested by a recent study of medullary carcinoma of the thyroid. The synthesis, metabolism, and function of vitamin D metabolites, the characterization and control of vitamin D like substances, the regulation of cutaneous previtamin D_3 photosynthesis in man as related to skin pigment and exposure to ultraviolet sunlight are also under investigation. The effect of exposure to sunlight on serum levels of vitamin D in the elderly and the subsequent effects on calcium metabolism in the bone disease of osteomalacia is an important area of research as approximately four million elderly persons suffer from this disease. Vitamin D is also being investigated for its role in treating renal osterodystrophy in children, and its relationship to the clinical problems of neonatal hypocalcemia, infantile rickets and osteopenia sudden infant death, and dental hypoplasia.

Investigations continue on the mechanism of action of vitamin K and anticoagulants, particularly coumarin's inhibition of vitamin K on the metabolism, and function of all the fat-soluble vitamins in studies to evaluate human requirements.

The water-soluble vitamins are also given a significant amount of research support. Studies on vitamin C are underway in an attempt to uncover the therapeutic efficacy of vitamin C in the treatment of alkali burned corneas, especially in its role as an nonspecific antioxidant that scavenges either oxygen or hydrogen peroxide in mammalian lenses exposed to photosensitizers and light; its mechanism of action on the bronchi; its effect on surgically induced osteoarthritis; the efficacy of high doses of vitamin C in the treatment of gingivitis; the pharmacokinetics of vitamin C and caffeine intake in the elderly; and the effect of oral contraceptives on vitamin C metabolism.

A double blind study tested in 44 twin pairs the efficacy of pharmacologic doses of vitamin C in preventing upper respiratory infections and examined other possible treatment effects. Preliminary results of the study indicate a statistically significant age x sex interaction in drug response with significantly fewer signs and symptoms of respiratory infections in young female twins, but not in males or older twins. In addi-

tion, a significant treatment effect on linear growth appeared in young male twins but not in females or older twins. A new co-twin control study of 29 pairs of young, monozygotic male twins has now been initiated in an effort to verify this observation and to permit the study of the heterogenious response to vitamin C treatment among genotypes in the population.

In other vitamin C research, particularly in relation to cancer, the histology, dietary habits and the recurrence rate of rectal adenoma are being examined in patients included in the third phase of a randomized double blind study on the effects of vitamin C in patients with polyposis coli who have undergone colectomy and ileorectal anastemosis. The data, to date, indicate that 3 grams of vitamin C per day has a modest effect in reducing the number of rectal polyps in patients with familial polyposis. Attempts are also underway to uncover the potential role of vitamin C as an inhibitor of n-nitrosamine production and methylcholanthriene induced carcinogenesis. In the area of cancer treatment several studies are underway to: determine the effectiveness of vitamin C in relieving symptoms and extending the lives of patients with advanced and pre-terminal cancer; to evaluate new treatments for patients with metastatic non-small cell lung cancer; and to determine if vitamin C enhances anti-tumor activity of certain other agents.

Research on nutrition and cancer also includes studies on the water soluble B vitamins, especially B_{12} and folate. Investigations are focused on the mechanism of uptake of these two vitamins in the lymphocyte and other mammalian cells, and the possible use of folate therapy to "rescue" normal cells from lethal doses of methotrexate used to treat lymphoma in mice. A pyridoxine (B_6) metabolite peculiar to rat hepatomas, an enzymatic process peculiar to pyridoxine deficient mice, and the role of pyridoxine in steroid hormone metabolism in cases of uterine and breast cancer are also under study in an attempt to shed some light on the relationship of diet and cancer.

Other studies on vitamin B_{12} and folate are investigating the vitamin B_{12} deficiency symptoms that appear as optic atrophy, leg paralysis, and low levels of odd chain fatty acids in the central nervous system; the kinetics of B_{12}, intrinsic factor and other proteins; the hematological role of B_{12} and its analogues; the transport of the microorganisms that produce B_{12}; B_{12} coenzyme synthesis and interconversions in a B_{12} deficiency; the effect of B_{12} on folate levels; and the structural and biochemical changes of nervous tissue and possible myelin damage that occurs in a B_{12} deficiency in the fruit bat. The results of the latter study could very well implicate the fruit bat as an appropriate animal model to study the many unsolved problems on the role of B_{12} in health and disease.

The metabolism of folate, folic acid binding proteins in folate metabolism, dietary control and assays of tissue folate stores, the absorption of monoglutamyl and polyglutamyl folates, the identification of folate factors in foods, the effect of alcohol and drugs on folate metabolism, and the effect of folate deficiency on the normal development of the

palate are areas also given research attention.

A number of studies are underway to investigate the role of pyridoxine (B_6), niacin, riboflavin (B_2), and thiamin (B_1). Delineation of the role of vitamin B_6 in the development of the central nervous system is important to an understanding of the gross neurological manifestations of B_6 deficiency. Studies are underway that use a biochemical-morphological approach to investigate the developing brain and spinal cord in B_6 deficiency. The research findings show that differentiation of dendrites and their branches, and the degree of myelination is markedly decreased by a deficiency of vitamin B_6. These data lead to speculation regarding possible interrelationships of B_6 with certain neuropathologies in humans including those leading to multiple sclerosis, leukoencephalopathy and encephalomyelitis.

Other research on vitamin B_6 is investigating the effect of long term use of oral contraceptives on vitamin B_6 needs of pregnancy. Preliminary data indicate B_6 levels in maternal blood, cord blood and milk are decreased in women who are long term users (3-1/2 years) of oral contraceptives. The estrogen content of the pills and estrogenic steroids in general selectively affect the function of pyridoxal phosphate in tryptophan metabolism. Studies are underway, therefore, to examine the relationship of vitamin B_6 to endocrine metabolism, in particular the specific needs of the vitamin to accomodate the increased excretion of tryptophan metabolites during pregnancy. In lieu of tryptophan being a precursor of niacin, investigators are also studying the relationship between the metabolism of B_6 and niacin.

Riboflavin is being studied for its role in decreasing the incidence of galactose induced cataracts, and in identifying the transport processes of substances into and out of the cerebrospinal fluid and choroid plexus of the brain. Thiamin is being studied for its physiological function in order to devise a method to study acetylcholine turnover, and to demonstrate central nervous system dysfunction with thiamin deficiency. The biosynthesis and transport of biotin, the functional component in acetyl-CoA carboxylase, are undergoing further investigation in an attempt to uncover the unknown catalyzing enzymes and intermediate metabolic products. A study is also underway on the renal metabolism of choline in terms of conditions that enhance its excretion.

APPENDIX D

FY 1980 INTERNATIONAL NUTRITION RESEARCH

INTERNATIONAL RESEARCH IN NUTRITION

The U.S. has a number of mechanisms that permit the support of research in other countries and encourage foreign investigators to carry out research in the U.S. The NIH conducts and supports a major portion of the world's biomedical research as it relates to health maintenance, human development throughout the life cycle, disease prevention, and disease treatment. Support for international nutrition research and training activities include studies on nutrition topics being conducted by foreign scientists either in the United States or abroad, studies being conducted by U.S. scientists abroad, and fellowships awarded to foreign scientists.

The implications of research results of nutrition studies in one country may contribute to solving the problems of another, if effective mechanisms for scientific communication and follow-up studies can be established and maintained. International nutrition research support involves both developed and developing countries. The affluent sections of the populations in developing countries have nutritional problems similar to those of the developed countries. The nonaffluent sections that comprise the majority of the populations in the developing countries suffer from malnutrition--with maternal and infant malnutrition accounting for a large proportion.

Table D-I gives an overview of the support mechanisms used by DRR, NCI, NEI, NHLBI, NIAID, NIAMDD, NICHD, NIEHS, and FIC for international nutrition research and research training activities of FY 1980. The table lists the numbers and dollars (in thousands) for grants, contracts, special foreign currency exchange, intramural research, fellowships and senior international fellowships. The specific countries collaborating on international nutrition research and training activities are referenced in terms of each support mechanism in the table. Total support for international nutrition research and research training activities was 4.7 million or 3.4 percent of total nutrition support at NIH.

Table D-II shows that international nutrition research activities totalled $4.6 million. In terms of total research support, 34 grants equal to $1.7 million account for 38 percent of the total, 24 contracts equal to $1.97 million account for 43 percent, and 2 special foreign currency exchange programs equal to $35,000 account for 1 percent. The extramural research activities equaled 81 percent of this total research support while intramural research accounts for 19 percent of the total dollars.

Table D-III shows that for international nutrition research training in FY 1980, two Institutes, namely NIAMDD and NICHD, and FIC supported seven fellows at a total cost of $127,000.

TABLE D-I

International Nutrition Research and Research Training by Institute by Mechanisms of Support, FY 1980
(dollars in thousands)

Institutes	Grants*		Contracts**		Special Foreign Currency Exchange****		Intramural Research+		Fellowships++		Senior International Fellowships+++		TOTALS	
	No.	Dollars	No.	Dollars	No.	Dollars	No.	Dollars	No.	Dollars	No.	Dollars	No.	Dollars
DRR	4	8											4	8
NCI	4	70	14	1,363									18	1,433
NEI	2	70											2	70
NHLBI	2	125	5	195	1	20							8	340
NIAID			1	34	1	15							2	49
NIAMDD	11	312	1	92					3	33			15	437
NICHD	10	1,113***	3	291			2	869	1	18			16	2,291
NIEHS	1	31											1	31
FIC											3	76	3	76
NIH TOTAL	34	1,729	24	1,975	2	35	2	869	4	51	3	76	69	4,735

* Belgium, Canada, Columbia, Denmark, Ecuador, England, Finland, Guatemala, Israel, Kenya, Peru, Sweden, Thailand, United Kingdom.

** Canada, Chile, Colombia, Costa Rica, Ecuador, El Salvador, France, Honduras, Iran, Israel, Italy, Jamaica, Mexico, Norway, Peru, Scotland, Tanzania, United Kingdom, USSR.

*** Includes 1 program project in Mexico ($392,000)

**** Egypt, Poland.

\+ Greece, Israel.

++ Israel, Netherlands, New Guinea, United Kingdom.

+++ Netherlands, United Kingdom.

TABLE D-II

International Nutrition Research by Institute and Mechanism of Support, FY 1980

Institutes	Grants*		Contracts**		Special Foreign Currency Exchange****		Intramural Research+		TOTALS	
	No.	Dollars	No.	Dollars	No.	Dollars	No.	Dollars	No.	Dollars
DRR	4	8							4	8
NCI	4	70	14	1,363					18	1,433
NEI	2	70							2	70
NHLBI	2	125	5	195	1	20			8	340
NIAID			1	34	1	15			2	49
NIAMDD	11	312	1	92					12	404
NICHD	10	1,113***	3	291			2	869	15	2,273
NIEHS	1	31							1	31
FIC									0	0
NIH TOTAL	34	1,729	24	1,975	2	35	2	869	62	4,608

* Belgium, Canada, Columbia, Denmark, Ecuador, England, Finland, Guatemala, Israel, Kenya, Peru, Sweden, Thailand, United Kingdom.

** Canada, Chile, Colombia, Costa Rica, Ecuador, El Salvador, France, Honduras, Iran, Israel, Italy, Jamaica, Mexico, Norway, Peru, Scotland, Tanzania, United Kingdom, USSR.

*** Includes 1 program project in Mexico ($392,000)

**** Egypt, Poland.

\+ Greece, Israel.

TABLE D-III

International Nutrition Research Training
by Participating Institutes and FIC

Institute	Fellowships+		Senior International Fellowships ++		Total	
	No.	Dollars	No.	Dollars	No.	Dollars
NIAMDD	3	33			3	33
NICHD	1	18			1	18
FIC	___	____	3	76	3	76
NIH TOTAL	4	51	3	76	7	127

+ Israel, New Guinea, Netherlands, United Kingdom.
++ Netherlands, United Kingdom.

Descriptions of the research supported by NCI, NEI, NHLBI, NIAID, NIAMDD, NICHD, NIEHS, DRR and FIC in FY 1980 are given below.

NATIONAL CANCER INSTITUTE

Cooperative cancer research programs under formal government treaties and other forms of bilateral agreements comprise a major segment of the international activities of the National Cancer Institute (NCI).

Nutrition projects supported by bilateral agreements in FY 1980 fall under the U.S.-Japan Cooperative Cancer Research Program that includes a cooperative cancer program classified into four broad program areas: etiology, cancer biology and diagnosis, cancer treatment, and interdisciplinary research. Under this program, seminars, meetings, and workshops are convened and scientists' exchanges in cooperative research projects include visiting and lecturing at many laboratories and institutions in both countries. For example, a "Seminar on Gastrointestinal Cancer" was held in Honolulu, Hawaii, on March 3-6, 1980, to consider the possible relationship of diet to colon and stomach cancer.

Also under the auspices of bilateral agreements, two American scientists went to Japan to engage in nutrition research; one is investigating the purification and identification of mutagens in cooked meat and fish at the University of Tokyo, and the other is investigating the mutagenicity of edible seaweed at the National Cancer Center Research Institute in Tokyo. The cooperation in cancer research has been productive, and interactions among scientists from both countries have engendered interpersonal relationships and mutual respect.

Several international epidemiological investigations of selected population groups are elucidating the possible role of diet and/ or nutritional status on the incidence, pathogenesis, and natural histories of cancer. The Japan-Hawaii Cancer Study is a long term prospective study of a cohort of over 6000 Japanese men in Hawaii who are being monitored primarily for morbidity and mortality from stomach cancer and large bowel cancer.

In order to identify patterns of cancer incidence in various ethnic populations, epidemiological studies carried out in Hawaii are based on the racial, ethnic and dietary heterogeneity of the population where ethnic groups include Japanese, Caucasian, Filipino, Chinese, and Hawaiian.

In Cali and other cities of Colombia, projects are underway to determine site-specific cancer incidence, and to correlate morbidity data with pathology findings. Similarly, epidemiological studies are being carried out in Tel Hoshemu, Israel to investigate whether dietary fats and low cellulose are risk factors in the etiology of breast cancer. The characteristics of patients with different types of noninvasive breast lesions are under study with particular attention to factors associated with breast cancer.

The World Health Organization's International Agency for Research on Cancer in Lyon, France, is conducting a study in Iran to examine the relationship of the incidence of esophageal cancer with factors such as heredity, immune response, opium use, food (mostly wheat) and wheat contaminants. Preliminary results suggest that the risk of developing cancer of the esophagus is linked to a low socioeconomic status and the consumption of a restricted diet. Results from the Cancer Mortality studies, underway in Bergen, Norway as part of the Norwegian migrant study, indicate that total vegetable intake and an index for vitamin C are negatively correlated with stomach cancer, particularly among younger patients and women.

In Leatherhead, United Kingdom, a dietary study with the British food manufacturers is underway to develop analytical methods for determining N-nitroso compounds in various types of food stuffs.

In Toronto, Ontario, the effect of nutritional support given during chemotherapy on tumor response and patient survival in patients with small cell anaplastic carcinoma of the lung is being investigated. In London, England, long term feeding studies of different retinoids are being carried out in order to help identify the optimum analogue, i.e. maximium anticancer activity coupled with minimium toxcity. Oral 13-cis retinoic acid in the chemoprevention of skin cancer is being investigated in Dar Es Salaam, Tanzania. People living in the equatorial zone are prone to nearly a 100% incidence of skin cancer.

Various animal models are being used in the study of cancer. In Milan, Italy, a study with a nutritional status component is exploring the feasiblity of developing pharmacologic agents to counteract the anorexia and cachexia of cancer in different animal models. A Primate Research Program in Malaysia, being coordinated in Cambridge, England, is developing field and laboratory research projects to investigate the role of diet on primate survival in Malaysia. Preserving viable populations of each species in their natural habitat, and conserving populations of each species in disturbed habitats, is emphasized. In Glasgow, Scotland, attempts are underway to characterize, compare, and contrast the three types of papilloma viruses in cattle cancer while investigating the synergistic effect of bracken fern consumption with papilloma virus.

Under the auspices of grant support many international studies in nutrition and cancer are underway. In Toronto, Ontario, the pathogenesis of liver cancer induced by chemicals in food, such as diethylnitrosamine 2 acetylaminofluorene, dimethylnitrosamine and other hepatic carcinogens, is being investigated. In Guelph, Ontario, the acute and chronic toxicity of malonaldehyde, a reportedly carcinogenic product of lipid peroxidation in foods and _in vivo_, is being evaluated in animals and cell culture.

In London, England, a randomized trial has been concluded on the role of ascorbic acid as an antioxidant in polyposis coli, which is used as a model for the study of both adenomas and cancers of the large bowel. The data reveal no clinically detectable ascorbic acid affect in reducing polyps. The data do suggest an effect on mucosal cell kinetics, and

analysis of these data is underway. In Denmark, a case control study is investigating the relationship of various environmental factors and the risk of cancers of the lower urinary tract (bladder, renal pelvis, and ureters).

A definite pattern for the future stems from the establishment of a more cohesive and collaborative atmosphere among researchers utilizing similar or different research approaches to cancer throughout the world.

NATIONAL EYE INSTITUTE

Xerophthalmia is an important cause of blindness and visual loss in some developing countries. In keeping with the mission statement of the NEI, two studies are underway on the role of vitamin A and its derivatives in conditions affecting the eye. As part of a three year study of the factors that lead to severe corneal xerophthalmia, investigators in Oxford, England, are conducting animal studies to determine the effects of preparations of different retinoids on the cornea of rabbits, and to investigate proteinases in the corneas of retinol deficient rats, etc. Also, clinical studies are underway in Madurai, India, to measure RBP in children with varying degrees of xerophthalmia and to investigate the effect of different treatment schedules on the appearance of RBP in serum.

In order to elucidate some of the basic characteristics of vitamin A metabolism especially with respect to the role of vitamin A binding proteins, investigators in Upssala, Sweden, are utilizing the techniques of both protein chemistry and cell biology. The specific aims of this research is to explore the biosynthesis and secretion of RBP and prealbumin under a variety of nutritional conditions, to determine the number, distribution, chemical characteristics and mode of operation of the cell surface receptor for RBP in normal and vitamin A deficient conditions, and to study the route of vitamin A transport to the cornea.

The International Agency for the Prevention of Blindness (IAPB) continues its cooperative efforts with NEI. Its mission is to speak to the world's conscience on the extent, magnitude and distribution of world blindness. IAPB is particularly interested in spreading this message to the governments of developing nations, where the greatest overburden of preventable blindness occurs. In addition, the developed nations are encouraged to provide the resources and expertise needed to prevent blindness, as well as to improve activities in order to cure blindness.

As many as 40 million people are blind. There is a critical need and a well established opportunity to prevent or treat much of this blindness. The NEI plays an important role in providing technical and medical advice to the U.S. Government's policymakers concerning the desirability and possible nature of U.S. participation in this endeavor. Additionally, NEI can help ensure that the most cost effective new approaches are utilized in an international program for the prevention of blindness through programs to evaluate emerging new technologies and to conduct clinically relevant research.

NATIONAL HEART, LUNG, AND BLOOD INSTITUTE

The problems of heart, blood vessel, lung and blood diseases and problems related to blood resources are receiving worldwide attention. They are major health problems, shared to a greater or lesser degree by all nations, both industrialized and developing. Some of the increased international attention to cardiovascular disease has been aroused by the recent success of the U.S. in bringing about a significant decline in the previously unchecked epidemic of deaths from cardiovascular disease. Exchanges of accurate epidemiological data with other nations will help NHLBI gain new knowledge about the relative contributions of various factors in the decline of cardiovascular disease in the U.S. Much remains to be accomplished before the U.S. approaches the much lower cardiovascular rates of such nations as Japan, Italy, and Yugoslavia.

The great majority of the NHLBI's international nutrition activities do not involve any direct support from the Institute. Most of the international programs are carried out by the principle of leverage whereby ongoing peer reviewed U.S. programs are linked with similar or parallel activities in other countries. This is accomplished by a series of government-to-government agreements, and the host country, in most cases, is responsible for all costs within its country including the costs for U.S. scientists and their program activities.

International nutrition activities are primarily carried out under bilateral agreements, and are intertwined with other activities both nationally and internationally. Nutritional factors are felt to be important both in atherosclerosis and hypertension. At the present time, cardiovascular disease is the main focus of international nutrition programs, however, ongoing studies are underway on the effect of nutrition on lung function and also on blood disease.

One of the goals of the NHLBI activities is the prevention of cardiovascular disease through reduction of those risk factors that are amenable to nutritional modification or treatment. Two Lipid Research Clinics have been established by the USSR in Moscow and Leningrad under the bilateral agreement of the Joint U.S.-U.S.S.R. Health Exchange in the Cardiovascular Area. The joint cooperative studies include consideration of nutritional factors.

Joint studies have tended to be epidemiological in nature, investigating the role of nutrition in conjunction with other factors related to cardiovascular disease. In cooperative studies with Japan, research is underway on nutrition, hypertension, and stroke. Epidemiological studies have been conducted to investigate the role of diet, lifestyle, and personal habits of Japanese men living in Japan, Honolulu, and San Francisco. Geographical differences in coronary heart disease mortality and the prevalence of risk factors have been documented in genetically similar populations of Japanese men. A Science and Technology U.S.-Japan Agreement in non-energy areas was signed on May 1, 1980. This agreement provides a formal mechanism for further development of U.S.-Japan studies on the role of nutrition in the development and sequelae of hypertension.

Collaborative activities with Italy conducted under a Memorandum of Understanding between DHHS and the Italian Ministry of Health are primarily supporting joint seminars, workshops, and exchange visits. Such activities are underway to examine the role of nutrition in improving cardiovascular function and preventing and treating cardiovascular disease. For example, a U.S.-Italy symposium on "Nutrition and Cardiovascular Disease" was held in Italy in December, 1980. In general, recent dietary trends in Italy are opposite to those in the U.S. with the consumption of animal fats and cholesterol rich foods having increased over the past 10-15 years.

Presently, a joint study on secular trends in coronary heart disease risk factors in Yugoslavia is being initiated between NHLBI and the Institute of Chronic Disease and Gerontology in Yugoslavia. One objective of this study is to establish a lipid laboratory for data collection purposes.

In the U.S.A., Canada, and Israel, the NHLBI has established Lipid Research Clinics to conduct epidemiologicial studies on the prevalence of lipid disorders, the effects of diet on these disorders, and their relationship to cardiovascular disease. These studies together with those conducted under the U.S.-U.S.S.R. Agreement are designed to generate internationally comparable information on plasma lipids and lipoproteins, cardiovascular risk factors, and demographic and nutritional data that will allow a comparision of the nature of the atherosclerosis problem. Preliminary data analysis collected from the prevalence study of dyslipidemia and its natural history in the Jewish population in Jerusalem show important differences in fat intake in relation to the parental country of origin.

A grant to Hebrew University is for research on the effects of several prescribed diets on the levels, composition, physical characteristics and metabolism of the high density lipoproteins and their major apoproteins.

As part of the U.S.-Polish Agreement for Health Cooperation signed in 1974 which provides counterpart P.L. 480 currencies, progress continues in the research on the Polish component of the ongoing European Collaborative Trial in Multifactorial Prevention of Coronary Heart Disease, signed in November 1976. The goal is to complete 10,000 screening examinations, 9,000 in factories designated as "intervention" factories and 1,000 (10% of the factory employees) in "control" factories. Risk factors targeted for intervention include hypercholesterolemia, obesity, hypertension, smoking, and lack of physical activity. Screening examinations show that cholesterol values, smoking and obesity are higher in more industrialized areas. Arrangements are being made for a Polish scientist to visit the U.S. to work with U.S. scientists on comparing the data generated in the Polish study with standards used by the NHLBI Lipid Research Clinic programs in the U.S. and other countries.

NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

Infectious diseases are the leading cause of reported morbidity and

mortality in developing countries, and malnutrition has been implicated as an important risk factor. In May, 1980 the International Centers for Medical Research (ICMR) of NIAID was superseded by the International Collaboration in Infectious Diseases Research Program (ICIDR) whose focus will be on infectious diseases.

In keeping with its mission statement, the NIAID supports the following international nutrition activities.

The NIAID provides indirect support towards collaborative research on oral rehydration studies being conducted by investigators at the Center for Vaccine Evaluation at the University of Maryland School of Medicine along with investigators from Costa Rica, Honduras, El Salvador, Jamaica, Chile, Ecuador, and Peru. These therapeutic trials are directly supported by the Pan American Health Association and the World Health Organization. Investigators are also studying the effect of different enteric microbial pathogens on vitamin A absorption after oral administration in adults.

In Egypt, one epidemiological study on diarrhea is supported by PL-480 funds. Collaborative investigators from NIAID and CDC are working on the rotavirus and nutrition portions of the project.

A WHO Rotavirus Reference Center located in the Laboratory of Infectious Diseases, NIAID, performs collaborative studies with foreign investigators by lending microbiological support for the diagnosis of rotavirus infections in infants with diarrhea. Some of these studies, done with indirect NIAID support, involve the interaction of diarrhea, infant growth, and nutrition.

The research supported by NIAID hopes to shed some light on the problems of immunity and infection as affected by various degrees of malnutrition present in the developing world.

NATIONAL INSTITUTE OF ARTHRITIS, METABOLISM, AND DIGESTIVE DISEASES

The U.S.-Japan Cooperative Medical Science Program was established in 1965 under Public Law 86-610. Research in malnutrition was added to the program in 1966 as it was recognized as contributing to increased mortality, morbidity, and infections, particularly in infants and children. The Malnutrition Panel, administered by NIAMDD as part of the U.S.- Japan Cooperative Medical Science Program, is one of the main avenues through which the NIH supports international nutrition research activities.

During FY 1980 research funded through the U.S.-Japan Malnutrition Panel totaled $1.25 million; of this, NIAMDD funded five grants for a total of $443,000. Studies supported by the program range from protein calorie malnutrition and the efficiency of energy utilization, to zinc and iron deficiency states. Specific areas of research involve work to develop new approaches and diagnostic tools for measuring metabolic adaptations to different levels of protein and energy intake; to gain information on how interactions among dietary concentrations of protein, carbohydrates,

and fat quantitatively influence the efficiency of energy and protein utilization; to determine the effects of zinc supplementation on skeletal growth and food intake in young children deficient in zinc; to consider zinc requirements in persons living in tropical climates; and to determine if specific enzymes are associated with behavioral disturbances and diminished intellectual performances in children deficient in iron.

Early results of one these studies, a double blind trial of zinc supplementation in young children, suggests that the zinc status of breast-fed infants is better than that of formula-fed infants, even if the formula is zinc fortified. Results of such studies are expected to supply some of the impetus for changes in recommended calorie and nutrient requirements, usuage of foods, and related patterns of dietary intake.

The Bone Disease program of NIAMDD supports a long term research effort headed by investigators at the Hadassah University Hospital in Jerusalem, Israel. Scientists are studying the effects of prolonged administration of a combination of calcium, phosphate, and fluoride salts on bone structure and density in middle-aged patients with osteoporosis. The relationship between long-term levels of intake of various dietary components and the prevalence and severity of osteoporosis among patients with different ethnic backgrounds, geographic origins, and dietary customs is being investigated. The possible prophylactic and therapeutic roles of the biologically active vitamin D metabolites are being studied.

Some of the ongoing NIH funded research aims to contribute to the prevention of bladder disease in Thai children; to an improved diagnosis of iron deficiency, and understanding of the bioavailability of iron to infants from mother's milk vs. cow's milk; to the refinement of amino acid requirements for preschool children; and to the understanding of the metabolic function of carotenoids and vitamin A. In Israel, studies are underway to determine risk factors contributing to glucose intolerance, the incidence of diabetes among new Yemenite immigrants, and the low insulin metabolic response of the spiny mouse. Studies on inborn errors of carbohydrate metabolism are underway in Belgium, while Canadian studies attempt to characterize the spontaneously diabetic Wistar Rat.

In the area of obesity, studies in Sweden and Denmark are investigating the role of genetics, the relationship of diabetes to adipose tissue development, and other factors that contribute to obesity. Other studies are attempting to elucidate the etiology of nutritional anemias, factors in human zinc deficiency, the effects of malnutrition on psychological development and physical stress, and the relationship between nutrient deficiences and immune system dysfunction.

NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT

International studies are crucial to the attainment of new knowledge about fetal and maternal health, and about the physical and mental development of infants and children. Nutrition research is not limited to particular disease entities, but rather examines the role played by

nutrition in permitting the full potential of individual development.

International nutrition research supported by NICHD includes studies of the impact of general and specific nutrient deficiencies on the physical and mental development of infants and children, and of the nutritional individuality exhibited by certain foreign populations, in the hopes of generating new and useful information that may be applicable to certain segments of the indigenous populations of the United States. Awareness of shared world health problems indicates a critical need for expansion of international research activities aimed at ameliorating and/or preventing morbidity or mortality.

A portion of the NICHD support for international nutrition research is funded under the auspices of the U.S.-Japan Malnutrition Panel; in FY 1980 the NICHD funded eight grants as part of the U.S.-Japan Program for a total of $802,000. In concert with its mission statement, the following international nutrition activities of NICHD are under way in FY 1980:

Investigators in Colombia are determining the effects of environmental deprivation and malnutrition early in life on mental development in an attempt to ascertain the extent to which food supplementation and psychological stimulation prevents intellectual retardation. The effect of food supplements on growth is also being investigated. Another study in Colombia is measuring the relationship of nutritional status and work capacity in children of upper and lower socioeconomic status. This study will provide a quantitative assessment of the influence of poor nutritional history on the development of physical work capacity as well as an opportunity to study the impact of urban life on the growth and development of children.

Data tapes from a 13-year longitudinal study in Guatemala testing the hypothesis that mild to moderate protein energy malnutrition adversely affects the mental development of children were prepared and have been deposited in the National Archives.

Another study in Guatemalan children is looking at the effect of oral iron administration on attention span, learning, and memory while at the same time collecting epidemiological data on zinc nutrition, lead poisoning and mortality rates. The biochemical impact of micronutrient deficits on function is being investigated. A third project in Guatemalan children is evaluating the impact of severe protein/calorie malnutrition on serum factors responsible for opsonization of bacteria. Deficiency of complement and of complement mediated opsonins, known to occur in malnourished hosts, may play a role in the high incidence of fatal gram negative septicemia in acute malnutrition.

International studies are particularly useful for comparing frequencies of breastfeeding and in evaluating reasons for changes in frequency within certain populations. The NICHD has recently initiated a contract in Israel to study the change from exclusive breastfeeding to either exclusive bottle feeding or a combination of breast and bottle feeding

in Bedouin populations of the Negev that are undergoing a transition from nomadic to sedentary lifestyles.

As more knowledge is attained on the numerous and possible benefits of breast-feeding, research continues on optimal maternal nutrition during pregnancy and on the effects of infant feeding practices and infant nutrition on subsequent development. In Mexico, a study comparing the composition of breast milk of mothers from Mexico City to mothers from Houston, Texas considers differences in ethnic background and diet, and exposure to agricultural and industrial toxins and pathogens.

In Peru, studies are underway with infants and small children to determine the relation between the amounts of rice, wheat, and potatoes that they can consume and digest and their protein needs.

The relationship between smoking, nutrition and social class in perinatal loss is being examined in data gathered by scientists in the Jerusalem Perinatal study.

In Kenya, one study is determining dietary patterns, time and task allocations, household income and expenses, and land and water resourses available to ramdomly selected households in order to test the hypothesis that nutritional status is partially correlated with family land holdings and water supply and that both cash cropping and wage labor migration contribute to its deterioration.

In Canada, investigators are studying the prevalence of lactase deficiency among the Inuit Eskimos and Indians. By ascertaining levels of vitamin D and its metabolites in children, the relationship between the prevalence of milk intolerance to the effectiveness of Canada's milk fortification program will be determined.

In the Louisiade Archipelago of Papua, New Guinea, data are being collected on cultural beliefs affecting diet, and on environmental factors affecting nutrient intake during childhood. Environmental factors include time devoted to various economic activities, land under cultivation, food exchange, feasts, seasonal variations in food intake, and the demography of illness.

In Greece, intramural scientists of the Section on Human Biochemical and Developmental Genetics of the Neonatal and Pediatric Medicine Branch have demonstrated that the chronic hemolysis in subjects with Mediterranean type glucose-6-phosphate dehydrogenase deficiency is significantly reduced by treatment with vitamin E supplementation. Significant increases in hematocrit and hemoglobin levels, reductions in reticulocyte count and prolongations of red cell survival have been documented.

NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES

In Finland, studies of the biochemical mechanisms and adaptations in the metabolism of environmental agents in the gastrointestinal tract and

lung are being studied. This project is providing information important to an understanding of how biologic systems adapt to changing chemical insult alone and in combinations, the mechanisms by which environmental compounds are biotransformed to more or less toxic metabolites, how chemical disposition in the gastrointestinal tract is influenced by dietary factors, and how pharmacokinetic and toxic changes in our target organs can influence the toxicity of environmental compounds in other organ systems.

Against the backdrop of continuing legislative, executive, and public interest, the NIEHS carries out its mission of providing the scientific manpower to achieve an understanding of the total impact of the environmental factors on human health. International collaboration continues to be an essential facet of this mission.

DIVISION OF RESEARCH RESOURCES

The Division of Research Resources, through the flexible funding of the Biomedical Research Support Program, has assisted several academic institutions in their nutrition research in Kenya, El Salvador, Mexico and China. One study is determining the prevalence of vitamin deficiencies in placental tissue of Kenyan women relative to their maternal and cord blood through enzyme saturation tests for thiamin, riboflavin, and vitamin B_6. The data suggest that these vitamins are less apt to be deficient in placental tissue than in maternal and cord blood.

A study is underway in growing school children of Durango, Mexico on the effect of iron and/or copper fortification in milk on the incidence of iron deficiency anemia. Preliminary data indicate that after drinking milk fortified with ferrous sulfate for three months, hemoglobin concentrations increased and anemia was eventually irradicated. The children receiving the iron supplement also missed fewer days of school and had a slightly greater gain in weight during the supplementation period.

The procedure for editing three years of surveillance data from the Ministry of Health of El Salvador has been developed and the initial tabulation of the data indicate consistent trends in the seasonality of malnutrition, diarrheal disease and respiratory disease in children. A clear relationship exists between the peak in diarrheal disease early in the rainy season and the rise in the reported cases of malnutrition. The complete data analysis will be aimed at a detailed epidemiological description of seasonal patterns, age group differences, and regional differences in reported cases of malnutrition, diarrheal disease and respiratory disease.

THE FOGARTY INTERNATIONAL CENTER (FIC)

The Fogarty International Center (FIC) supports Advanced Study Programs and the International Research Fellowship and Exchange Programs. The Advanced Study Programs, which include the The Fogarty Scholars-in-Resi-

dence Program, are an important means for the development of biomedical knowledge, acquisition and communication of research information. These programs draw on the expertise of U.S. and foreign scientists, administrators, and other specialists for study of various topics of current relevance. The International Research Fellowship Program and the Senior International Fellowship Program occasionally support fellows doing nutrition research.

In FY 1980 under the auspices of the Senior International Fellowship Program, three senior research fellows are conducting research in nutrition. In the United Kingdom, one fellow is measuring fecal microbial mass of normal subjects on various diets, and of patients with colonic diverticular disease and irritable bowel syndrome on standard diets. Another research fellow, also in the United Kingdom, is comparing the intestinal absorption of orally administered caffeine in a young population (20-40 years) and in a geriatric population (over 65 years). In the Netherlands, a senior research fellow is studying lipid metabolism in neoplastic mammary cells.

The NIH Visiting Program falls under the auspices of the International Visitors Center (IVC). Through this program distinguished scientists at all levels of their careers are invited to NIH to receive further training or to conduct research in their biomedical specialties. This program comprises Visiting Fellows, and Visiting Associates and Visiting Scientists. Some of the visiting scientists, fellows, and associates conduct research in nutrition under the support of the B/I/D's.

JOINT MEETINGS AND WORKSHOPS ON INTERNATIONAL NUTRITION RESEARCH

Many of the NIH Institutes and the Fogarty Center often join together to support meetings, workshops, or conferences held in the United States or abroad, related to international nutrition research questions. The Fogarty Center is responsible for coordinating the review and funding for these international scientific meetings by the Institutes and other Federal Agencies. In FY 1981 the use of contract support for conferences will be phased out and replaced by grant support. The eleven meetings pertaining to international nutrition research that were held in 1980 are:

1) "A Conference on Micronutrient Interactions: Vitamins, Minerals, and Hazardous Elements," cosponsored by the New York Academy of Sciences and NCI, NIA, NIAMDD, NIDR, NIEHS and FIC of the NIH, and USDA was held on February 20-22, 1980 in New York City. The purpose of the conference was to assemble scientists who have done research in micronutrient interactions, to discuss specific interactions of vitamins, minerals, or hazardous elements in order to establish the need and value of continued research in the field. The conference proceedings will be published as Volume 355 of The New York Academy of Sciences' Annals.

2) Under the auspice of the U.S.-Japan Cooperative Cancer Research Program and supported by a bilateral agreement, a "Seminar on Gastrointestinal Cancer" was held in Honolulu, Hawaii on March 3-6, 1980. The

seminar focused efforts on the integration of knowledge, concepts, and methods through discussions on the multidisciplinary search for the etiology of stomach and colon cancer, the comparative oncology of the stomach and the colon, and the comprehensive search for carcinogens, promoters and inhibitors of these two major types of cancer. Some of the points raised include the need to retest the hypothesis that meat consumption plays a role in colon cancer; the need for intervention studies using vitamins A, C, and E; and the need to consider the genetic influence on the occurrence of precursor lesions or other predisposing conditions such as possible carcinogens and promoters of carcinogens.

3) A conference cosponsored by NICHD and the International Organization for the Study of Human Development, entitled "Food, Nutrition and Evolution" was held on May 5-8, 1980 in Campione, Italy. This multidisciplinary conference addressed the issue of food as an environmental factor in the genesis of human variability. Papers presenting the behavioral, social, and cultural perspectives included such issues as the history of plant and animal domestication, the biocultural influences on the genesis of food preferences, taste and food preferences in the weaning of mammals, the ontogeny of taste, and weaning practices of primitive people.

4) "The Second International Symposium on Selenium in Biology and Medicine," funded by NIAMDD, NIDR and the FIC of the NIH and the Science and Education Administration (SEA), USDA, was held in Lubbock, Texas on May 13-16, 1980. The purpose of the symposium was to explore and discuss the most recent research findings and provide an update to the knowledge of selenium's role in biological functions. Some topics covered by the participants were selenium biochemistry, especially the elucidation of glutathione peroxidase activity; metabolism of selenium in light of its biological activity, its role in protecting against peroxide damage, and its distribution in animal tissue; and specific implications of selenium in relation to cancer, aging, immunity, fertility and heavy metal toxicity. Although a number of diseases in animals were categorized as selenium responsive diseases, the question remained as to whether selenium is necessary in the diet in humans. By outlining the relationship between selenium deficiency and the occurrence of Keshan disease, a cardiomyopathy that affects children from one to nine years of age, it was equivocally shown, in Chinese children, that a small amount of selenium is necessary in the human diet. The proceedings of this symposium will be published by the AVI Publishing Company.

5) "A Discussion Group on Infections and Undernutrition," sponsored by the FIC was held in collaboration with NIAID on June 16-17, 1980 at the NIH to explore the interaction of nutrition and infections, particularly as they occur in the Third World. The group consisted of a panel of international experts in childhood nutrition, infectious diseases, immunology, and health planning who discussed the complex issues of nutrition, immunity, and infection. The importance of breastfeeding and the debilitating effect of diarrhea, measles and malaria on infant growth and development were underscored. The workshop proceedings will be published in a scientific journal for distribution to the international

health care and nutrition community.

6) A "Conference on Vitamin B_6 Methods - Nutrition Status," supported by NIAMDD, NCI, and FIC of the NIH, and SEA of USDA, was held June 29-July 2, 1980 in Mt. Hood, Oregon to review the current state of the art for measuring different forms of vitamin B_6 or pyridoxine in order to assess nutritional status. A new chromatographic method that utilizes radioimmunoassay or enzyme-limited immunosorbant assay (ELISA) procedures for separating out the various metabolic forms of pyridoxine was explained. The use of this improved method for measuring pyridoxine levels in nutritional status surveys was encouraged. As a result of the conference a book entitled Methods in Vitamin B_6 Nutrition is being published by Plenum Publishing Corporation.

7) At a meeting in New Delhi in March, 1980, convened to delineate areas for potential U.S.-Indian collaboration in nutrition research, it was decided that the first area to be developed will be the maternal-fetal aspects of vitamin A nutrition.

8) A joint Indian-American working group met in July, 1980 at the NIH to discuss the possibility of a workshop and/or research projects on the interaction of vitamin A and the eye, human growth and development, and infections and immunity. Special foreign currency funds will be used to help defray Indian travel expenses and future work in India. Four Institutes, NEI, NIAMDD, NICHD, and NIAID, are involved in the initial planning.

9) A Workshop on "The Effect of Nutrition on Human Growth and Development and Later Life and Health: Global Priority Issues" was held on July 29-30, 1980 in Morioko, Japan after the fifteenth Joint Malnutrition Panel Meeting. The workshop, cosponsored by the U.S and Japanese Malnutrition Panels of the U.S. Japan Cooperative Medical Science Program, addressed the possible effects of nutritional insults to the young on their subsequent potential to live healthy and productive lives. Particular attention was given to perinatal and neonatal nutrition, especially the effect of early nutrition on cell size and subsequent obesity, and on the possible relationship of early nutrition to conditions associated with nutritional status in later life. The NIH traveled eight persons to the workshop.

10) "The Western Hemisphere Nutrition Congress VI," partially funded by NCI, NHLBI, NIA, NIAMDD, NICHD, DRR, and FIC of the NIH, the Bureau of Foods, FDA, and SEA of USDA was held on August 10-14, 1980 in Los Angeles, California. The Congress was organized by the American Institute of Nutrition, the Department of Foods and Nutrition and the Council on Continuing Physicians Education of the American Medical Association, the Nutrition Society of Canada, the American Society for Clinical Nutrition, and the Sociedad Latinoamericana de Nutricion. The theme of the Congress was "Nutrition in the 1980's--The Constraints of Our Knowledge." The purpose of the conference was to assemble those scientists working toward solutions of diverse problems related to nutrition and the food supply. Topics discussed included immunity and the metabolic effect of plant fiber, a function test for nutritional status, trace elements, clinical nutrition, dietary sources of protein, etc. Program participants analyzed

the current state of scientific knowledge on many aspects of food, nutrition and related sciences, the methods used to determine the nutritional needs of individuals and populations and the procedures for establishing national policies and priorities for nutrition intervention.

11) "The International Symposium on The Metabolic and Clinical Implications of Branched Chain Amino And Ketoacids," supported by NIAMDD, was held on November 14-17, 1980 at Kiawah Island, Charleston, South Carolina. Branched chain amino acids (valine, isoleucine and leucine) and their nitrogen free analogues, the branched chain ketoacids, have been recognized for their clinical importance in a variety of disorders including the portal-systemic encephalopathy, chronic renal failure, and urea cycle enzyme defects. This symposium provided a forum for the presentation of recent research concerning the regulation of the metabolic pathways of branched chain amino and keto acids, their effect on other metabolic processes in the cell and their potential uses as therapeutic agents in various disorders.

A Joint Indian-U.S. Conference on Diarrheal Diseases is being considered for 1981. If approved, it will be held in India in 1981 using Special Foreign Currency funds. A portion of the conference will consider the important interaction of nutrition and enteric infections. NIAID will be the lead Institute.

INTERNATIONAL NUTRITION EDUCATION ACTIVITIES

International Dissemination of Nutrition Information

The dissemination of nutrition information on the research questions being asked by various countries, on the results of research being conducted, and on the seminars being planned, is crucial in order to maintain and stimulate international collaboration on nutrition related problems. Many of the NIH Institutes are involved in international dissemination of nutrition information. For instance, results of studies on the relationship between nutrition and cardiovascular disease are made available from the NHLBI to many scientists worldwide. As a result, the NHLBI nutrition education programs aimed at preventing cardiovascular disease are of particular interest to many scientists and government officials from developing countries. Also, an informational series on the dietary management of hyperlipoproteinemias is available to foreign physicians and nutritionists upon request.

Media-based nutrition intervention programs successful in altering the food purchase patterns in the U.S. have been discussed with scientists and government officials from France, Yugoslavia, and other countries. It is hoped that a more formalized collaboration of mutual benefit will result from this international dissemination of nutrition information.

FUTURE COOPERATION IN INTERNATIONAL NUTRITION ACTIVITIES

1. Joint cooperative studies with the People's Republic of China are planned in several areas of cardiovascular research. Nutrition will be an important component of the large scale epidemiological studies in arteriosclerosis and hypertension. Present studies have shown that Chinese diets contain several agents that have a strong inhibiting effect on platelet function. Some of these agents may play a role in the lower rates of cardiovascular disease especially in South China. A working conference on nutrition and genetics will be held in China in late 1981. Joint studies that may result from this workshop have potential for great significance because of the diversity of ethnic groups within China.

2. An agreement signed in January 1980 between DHHS and the Ministry of Health of the State of Israel for Cooperation in the field of Health identifies nutrition among the areas of cooperation (Article II) for developing joint activities.

3. At a meeting of the Indo-U.S. Subcommission of Science and Technology, the Scientific Working Group on Medical and Health Sciences emphasized developing Indo-U.S. programs on collaborative research in nutrition. Follow-up joint studies on nutrition may be supported by The Special Foreign Currency Program. The workshop on vitamin A planned for late 1981 will develop protocols on aspects of vitamin A deficiency other than blindness, emphasizing vitamin A supplementation during pregnancy and lactation.

4. A Subcommittee to evaluate nutrition proposals for funding by CDC Special Foreign Currency projects was identified at the Joint Meeting of the U.S.-Egypt Working Group on Health Cooperation held July 6-7, 1979. U.S. and Egyptian scientists are interested in future joint studies on diet, lipids, and cardiovascular disease.

5. Scientists from Africa have expressed concern over the growing problems of hypertension on the African Continent. Findings to date offer hope that the rapidly accelerating hypertension problem in developing countries could be prevented or controlled in the foreseeable future by appropriate dietary changes.

6. U.S. and Nigeria are discussing the estasblishment of a collaborative nutrition research program. The focus of the program will be on the interaction of the individual with diet and its influence on child health and development. Two areas have been proposed for study protocols: The determinants and outcomes of weaning practices, and the relation of nutritional status to functional development.

APPENDIX E

DHHS NUTRITION RESEARCH INITIATIVE

HHS HEALTH RESEARCH PLANNING

HEALTH RESEARCH ACTIVITIES OF THE DEPARTMENT OF HEALTH AND HUMAN SERVICES

Program Planning and Proposed Initiatives for Fiscal Year 1981

A Report of the HHS Steering Committee for the Development of a Health Research Strategy

December 1980

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Pubiic Health Service National Institutes of Health

Chapter 16

NUTRITION RESEARCH

Sponsoring agency:

National Institutes of Health
Office of the Director

Cosponsors:

National Institutes of Health
All Institutes and the Division of Research Resources

Alcohol, Drug Abuse, and Mental Health Administration

Food and Drug Administration

Center for Disease Control

Office of Health Research, Statistics, and Technology
National Center for Health Statistics

Initiative coordinator:

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Chapter 16

NUTRITION RESEARCH

Purpose and Rationale

The purpose of the nutrition research initiative is to develop within the Department of Health and Human Services a more comprehensive and effective program of nutrition research and training to strengthen support for related missions. To carry out this initiative, it will be necessary to structure a committee on the biomedical and behavioral aspects of nutrition research and training that will include all the agencies within the Department that either carry out or sponsor nutrition research and training. Departmental research so coordinated will in turn relate to broader Federal coordination efforts.

Within HHS, aspects of nutrition research, training, and its applications are supported by all 11 Institutes and 1 Division of NIH and by 5 other agencies of the Public Health Service. Their activities include:

- Support for basic and applied biomedical and behavioral research on the role of nutrients (carbohydrates, fats, proteins, vitamins, minerals, and water) and some nonnutrients, such as fiber, in human growth and development, health maintenance and promotion, and disease prevention

- Research in support of regulatory activity, including studies of human requirements for nutrients, their potential toxicity, and their interactions with one another and with toxic substances;

- Epidemiologic studies of diet and surveillance of nutritional status in selected populations, and the development and standardization of clinical tests and measurements appropriate to such studies;

- Assessment of nutritional status of the U.S. population;

- Nutrition research training and manpower development; and

- Nutrition curriculum development in medical schools, and nutrition education for health care providers and the public.

The appropriateness of an HHS initiative in nutrition research is suggested by rapidly growing scientific interest, lively public debate on the pertinence of nutrition to particular health problems, and evolving Federal efforts to coordinate nutrition research at both policy and program levels.

Nutrition Research

The interest of scientists has tended to focus on the precise role of nutrition in the promotion of health and the prevention and treatment of disease. As shown by a number of polls and surveys, the public also maintains a high interest in nutrition, especially its role in health maintenance and disease prevention.

Nature of the Health Problem

Nutritional science has seen the elimination of the ravages of many diseases caused by specific dietary deficiencies. It is now becoming apparent, however, that nutritional diseases are still among the most important health problems in the United States; and many diseases, such as atherosclerosis, hypertension, dental caries, obesity, alcoholism, and some forms of cancer, have nutritional components.

An important form of malnutrition in the United States is obesity. It is a primary risk factor for hypertension, increasing the morbidity and mortality from that disease, and is associated with diabetes. In addition, it imposes obvious social disadvantages on those afflicted. About 30 percent of men and 40 percent of women between the ages of 40 and 49 are overweight. A significant portion of these are technically "obese"--in excess of 20 percent above optimum weight. Obese children are three times more likely to be obese adults than children who are not overweight. Obesity is disproportionately common among persons in the least privileged socioeconomic groups.

Poor nutrition, in terms of undernutrition, detracts from the health of pregnant women, particularly adolescents, and leads to poor fetal development and to babies of low birth weight. Malnutrition of hospitalized patients leads to prolonged stays in hospitals and thus increased medical care costs. On the other hand, proper nutrition may improve the health status of the elderly.

Relationship to the Health Research Initiatives

The nutrition initiative relates to all five health research principles:

- Development of the relevant science base would maintain, encourage, and coordinate support for fundamental research in all aspects of human nutrition and its effects.
- In terms of clinical applications, the initiative would support and coordinate clinical research in nutrition and develop curricula aimed at imparting this knowledge to present and future health care providers.
- Through support of research on the safety of foods, food additives, and dietary supplements, the knowledge base is provided for regulatory action to ensure the safety of the Nation's food supply. Through epidemiologic surveys and surveillance, nutritional deficits and other nutritional problems are detected in target populations. Correlations are established among diet, nutritional status, and health, through

surveys such as the key Health and Nutrition Examination Survey (HANES).

- As for provision for research resources, the initiative would coordinate support for nutrition research training and manpower development and encourage interdisciplinary approaches to the solution of nutrition research problems.

- Finally, in terms of the fifth or unifying principle, the initiative would encourage broadly based inputs into program decisions through workshops, national and international conferences, and interaction with certain groups. These include the Office of International Health/ Office of the Secretary, HHS; the Joint Subcommittee on Human Nutrition Research/Office of Science and Technology Policy (JSHNR/OSTP); the HHS and NIH Nutrition Coordination Committees; and the ongoing peer review processes of the PHS.

Implementing Arrangements

Current Scope of Research Activity

The following HHS agencies support programs in nutrition research:

National Institutes of Health. NIH, under its very broad research mandate provides the main Federal support for biomedical and behavioral nutrition research and research training. All 11 Institutes and the Division of Research Resources support aspects of this research, which include the role of nutrients on human growth and development, health maintenance and promotion, disease prevention, and disease treatment; the role of nutrition during pregnancy, infancy, and old age; research on nutrient toxicity, bioavailability, and interaction, as well as on food composition and dietary and nutritional status; and nutrition education research as a component of some of the intervention trials.

Alcohol, Drug Abuse, and Mental Health Administration. The ADAMHA nutrition research program, primarily housed in the National Institute of Mental Health, focuses on biological, behavioral, and psychological factors in the development of obesity and anorexia nervosa; cognitive, emotional, motivational, and other psychosocial factors that may be predictive of these nutrition-related behaviors; assessment of the impact of psychotherapeutic drugs on the nutritional status of psychiatric patients; the relationship of nutrition to normal and abnormal brain development; the effects of alcohol on fetal development; and the interaction of alcohol with nutrients and drugs.

Food and Drug Administration. The nutrition research program of the Bureau of Foods, FDA, is directed toward studies that will provide data for regulating the nutritional quality and safety of the food supply, the practice of sound nutrition principles for the dietary management of disease or special physiologic states, and the establishment of food-labeling criteria to protect the consumer from misleading information or fraud. This research program comprises both experimental and clinical nutrition research in nutrient toxicity, nutrient interactions, and nutrient bioavailability. In addition, the FDA conducts research on the development of methodology for the determination of nutrients and other substances found in food and for the measurement of food

consumption and consumer behavior relative to food purchasing.

Center for Disease Control. The CDC carries out surveillance in specific population groups and thus generates new knowledge needed for the direction of further research efforts in nutrition. In addition, CDC's clinical laboratory monitors quality control and develops methods applicable in the field for surveys, including HANES.

National Center for Health Statistics. Through its HANES program, the NCHS, in the Office of Health Research, Statistics, and Technology (OHRST), surveys and monitors nutritional status in a national probability sample of the U.S. population, and relates these data to a variety of simultaneously determined health parameters, thus broadening our knowledge of nutritional status of the population.

Existing Arrangements

NIH, recognizing the need for a coordinated approach in this multidisciplinary field, established the NIH Nutrition Coordinating Committee (NIH-NCC) in 1975, with members from each of the Institutes and Divisions that support nutrition research. The purpose of the Committee is fourfold: to review and comment on the plans, execution, and results of research efforts in order to develop the Program in Biomedical and Behavioral Nutrition Research and Training; to process and respond to incoming requests for nutrition information from HHS and other Federal agencies, the higher Executive Branch, the Congress, scientific institutions, and the public; to maintain up-to-date information on NIH funding and nutrition research activities; and to develop and monitor the means for improving the coordination of these activities.

Over the past two years, the NIH-NCC has expanded to include liaison members from additional NIH components that have an interest in nutrition, such as the National Library of Medicine, and from other agencies of PHS, notably the National Institute of Mental Health and the National Institute of Alcohol Abuse and Alcoholism of ADAMHA; FDA; the Bureau of Health Manpower of HRA; CDC; and the National Center for Health Statistics of OHRST. These liaison members regularly attend the monthly NIH-NCC meetings and participate in Committee activities.

At the level of the PHS, the Chairman of the NIH-NCC is also the Chairman of the Subcommittee of Nutrition Research of the DHHS-NCC and a member of both the DHHS-NCC and the DHHS-Nutrition Policy Board.

Above the PHS and HHS levels, interdepartmental coordination in nutrition research is achieved through the Joint Subcommittee on Human Nutrition Research (JSHNR) of OSTP, which the chairman of the NIH-NCC cochairs. This subcommittee includes representatives from the Agency for International Development, Department of Agriculture, Department of Defense, Department of Health and Human Services, Federal Trade Commission, National Science Foundation, Veterans Administration, National Aeronautics and Space Administration, and OSTP.

The JSHNR is concerned with all federally supported or conducted research on human nutrition and professional personnel needs in human nutrition research

and education. The purpose of the JSHNR is to increase the overall effectiveness and productivity of Federal research efforts in human nutrition.

The NIH-NCC has facilitated the development of a comprehensive trans-NIH program in the biomedical and behavioral aspects of nutrition research and training. This program consists of the following major components: nutrition and disease prevention, nutrition and genetics, behavioral studies in nutrition, international studies in nutrition, nutrition and epidemiology, obesity, nutritional status, maternal nutrition, child and infant nutrition, nutrition and aging, total parenteral nutrition, nutrition education research, and nutrition education for the public and for professionals.

Significant accomplishments of the NIH-NCC include:

- A major new development of joint efforts in nutrition research among NIH, ADAMHA, FDA, and CDC is the establishment of the five-year study of infants who developed hypochloremic metabolic alkalosis following feedings of a chloride-deficient formula. The study, established at the request of the NCC office, is carried out by intramural scientists of the NIH and ADAMHA, with FDA and CDC scientists as advisers.

- The development of a program announcement on overnutrition and obesity, with participation from several Institutes--NIAMDD, NHLBI, NIA, NIAID, NICHD, and NINCDS--and inclusion of the research needs of the FDA.

- A concerted attempt to attract additional scientists, through National Research Service Awards for institutions and individuals (postdoctoral fellowships), into areas of specific interest in nutrition research. Institutes participating in these announcements include the NCI, NEI, NHLBI, NIAID, NIA, NIAMDD, NIDR, NIEHS, and NINCDS. In expanding manpower development in nutrition, NIH and ADAMHA have developed a joint announcement for New Investigator Research Awards that includes NIA, NCI, NIAMDD, NICHD, NIDR, NIMH, and NIAAA.

- The publication of a Request for Applications for core grants to establish Clinical Nutrition Research Units, with the participation of three Institutes: NIA, NIAMDD, and NCI.

- Conference on Nutritional Status: Research and Surveys, cosponsored by NIH, FDA, CDC, and NCHS-HANES, to be held September 16-18, 1981.

- The establishment by the DHHS-NCC of a Subcommittee on Nutrition Research and Research Training, including research into nutrition education. The Subcommittee, chaired by the chairman of the NIH-NCC, draws its members from ADAMHA, FDA, CDC, and NCHS-HANES.

Proposed Scope of Research Activities

The principal thrust of the nutrition research initiative will be to reinforce the coherent research program that has been developed and to extend the growing trans-Institute cooperation in the area of nutrition research to other agencies. In this way an appropriate program can be mutually supported and strengthened. A global view of problems will also permit more rapid

identification of knowledge gaps, with cooperative action toward their solution.

For the further development of nutrition research and training activities under the initiative, it is anticipated that a key role will be played by the recently established NIH program of core grants for Clinical Nutrition Research Units (CNRUs). The creation of such core grant units is considered the most feasible way to integrate the research, education, and service activities that are oriented toward human nutrition in health and disease.

NIH funded seven such units in fiscal 1979 and '80 throughout the United States. Thus, a strengthened national program on the biomedical and behavioral aspects of clinical nutrition has been established, including fundamental research, clinical investigations, and population studies, and will provide the appropriate environment for the support of training and nutrition services. Under consideration is the issuance of another Request for Applications on CNRUs, with increased participation from other Institutes within NIH, FDA, ADAMHA, and other agencies. The FDA has signified its intent to join NIH in this program (through the mechanism of interagency reimbursement agreements) by supporting additional CNRUs, where the research will be geared to the study of nutrient toxicity and of nutrient-drug interactions throughout the life span, but with particular emphasis on infants and children. The HRA has expressed interest in joining the CNRU program in order to expand the nutrition training and education of physicians and other health professionals. Discussions with ADAMHA may lead to its support of additional CNRUs whose research will focus on the behavioral and psychological aspects of extremes in nutrition, such as anorexia nervosa and obesity, and the relationship of nutrients to neurotransmitters. Another unit is envisioned as becoming the focus for studies on interrelationships of alcohol and nutrition and on the interaction of drugs and nutrients to influence drug abuse.

In addition, intramural coordination, principally between NIH and NIMH/ADAMHA, will occur through the establishment of an intramural CNRU.

It is expected that data developed by such a national program in clinical nutrition research will be used by other agencies, such as NCHS and CDC, for nutrition surveillance and for a nutritional-status monitoring system.

The specific objectives of the CNRU program are--

- To create or strengthen foci in biomedical research institutions for multidisciplinary research in clinical nutrition, in order to develop new knowledge about specific nutrients in health, human development, and the prevention and treatment of disease;
- To strengthen training environments in order to improve the education of medical students, house staff, practicing physicians, and paramedical personnel in clinical nutrition; and
- To enhance patient care and promote good health by focusing attention on clinical nutrition and generating nutritional information for the public.

New Arrangements

To carry out the nutrition initiative and develop a cohesive program for the Department, it will be necessary to stucture a committee with members (one or more as appropriate) from the six agencies that conduct or support nutrition research and training: NIH, FDA, ADAMHA, CDC, and OHRST/NCHS. This Committee on the Biomedical and Behavioral Aspects of Nutrition Research and Training will have the following responsibilities:

- Review and comment on the plans, execution, and results of research efforts, in order to refine and strengthen the Department's nutrition program;
- Coordinate research stemming from the obesity program, the CNRUs, nutrition research training and manpower development programs, and participation in OSTP's JSHNR;
- Provide information and advice on the nutrition research program to the directors of the agencies involved, to the Office of the Assistant Secretary for Health, and to the Office of the Secretary;
- Continuously evaluate research data and provide advice for the development of nutrition education materials for the public; and
- Plan and arrange for conferences, workshops, consensus development exercises, and reports as appropriate.

Table 9. RESOURCES FOR FY 1980-1981
(Dollars in Thousands)

	FY 1980	FY 1981 Budget
ADAMHA	$ 4,954	$ 5,429
FDA	4,389	4,690
CDC	220	240
OHRST/NCHS*	---	---
NIH	146,384	153,683

*The NCHS, a general-purpose statistical agency, will be actively involved in this initiative through conduct of the HANES study and support of other agencies' efforts by interagency agreements.

APPENDIX F

FY 1980 NUTRITION EXPENDITURES BY INSTITUTE AND DIVISION

Table F-1

National Cancer Institute
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1980
(in thousands of dollars)

Item		Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural					
Research grants:	Regular	228	$10,595		
	Clinical trials	13	768		
	Total			241	$ 11,363
Program projects:	Regular	21	3,709		
	Clinical trials	1	56		
	Total			22	3,765
Contracts:	Regular	105	6,902		
	Clinical trials	12	1,256		
	Total			117	8,158
Centers:	Regular	26	1,703		
	Clinical trials	0	0		
	Total			26	1,703
Research support				0	0
Reimbursement agreements				7	891
Training:	Training grants	8*	158		
	Fellowships	0*	0		
	Total			8*	158
Research Career Development Awards				6*	227
New and Academic Investigator Awards				4*	102
Subtotal - Extramural					$ 26,367
Intramural					
Projects				29	2,320
Training				0*	0
Subtotal - Intramural					$ 2,320
TOTAL NUTRITION RESEARCH AND TRAINING - NCI					$ 28,687

*Number of persons.

Table F-2

National Eye Institute
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1980
(in thousands of dollars)

Item		Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural					
Research grants:	Regular	46	$ 2,533		
	Clinical trials	3	791		
	Total			49	$ 3,324
Program projects:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Contracts:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Centers:	Regular	1	12		
	Clinical trials	0	0		
	Total			1	12
Research support				0	0
Reimbursement agreements				0	0
Training:	Training grants	0*	0		
	Fellowships	5*	92		
	Total			5*	92
Research Career Development Awards				1*	16
New and Academic Investigator Awards				2*	52
Subtotal - Extramural					$ 3,496
Intramural					
Projects				7	670
Training				0*	0
Subtotal - Intramural					$ 670
TOTAL NUTRITION RESEARCH AND TRAINING - NEI					$ 4,166

*Number of persons.

Table F-3

National Heart, Lung, and Blood Institute
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1980
(in thousands of dollars)

Item	Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural				
Research grants: Regular	176	$13,197		
Clinical trials	3	1,308		
Total			179	$14,505
Program projects: Regular	12	2,937		
Clinical trials	0	0		
Total			12	2,937
Contracts: Regular	16	966		
Clinical trials	51	6,811		
Total			67	7,777
Centers: Regular	14	4,242		
Clinical trials	0	0		
Total			14	4,242
Research support			0	0
Reimbursement agreements			7	440
Training: Training grants	70*	1,206		
Fellowships	4*	43		
Total			74*	1,249
Research Career Development Awards			4*	150
New and Academic Investigator Awards			10*	284
Subtotal - Extramural				$31,584
Intramural				
Projects			1	515
Training			6*	85
Subtotal - Intramural				$ 600
TOTAL NUTRITION RESEARCH AND TRAINING - NHLBI				$32,184

*Number of persons

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Table F-4

National Institute on Aging
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1980
(in thousands of dollars)

Item		Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural					
Research grants:	Regular	38	$ 1,940		
	Clinical trials	0	0		
	Total			38	$1,940
Program projects:	Regular	11	$ 1,129		
	Clinical trials	0	0		
	Total			11	$1,129
Contracts:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Centers:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Research support				0	0
Reimbursement agreements				1	300
Training:	Training grants	7*	16		
	Fellowships	5*	19		
	Total			12*	35
Research Career Development Awards				1*	20
New and Academic Investigator Awards				14*	119
Subtotal - Extramural					$ 3,543
Intramural					
Projects				12	677
Training				0	0
Subtotal - Intramural					$ 677
TOTAL NUTRITION RESEARCH AND TRAINING - NIA					$ 4,220

*Number of persons.

Table F-5

National Institute of Allergy and Infectious Diseases
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1980
(in thousands of dollars)

Item	Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural				
Research grants: Regular	20	$ 918		
Clinical trials	0	0		
Total			20	$ 918
Program projects: Regular	1	43		
Clinical trials	0	0		
Total			1	43
Contracts: Regular	1	34		
Clinical trials	0	0		
Total			1	34
Centers: Regular	0	0		
Clinical trials	0	0		
Total			0	0
Research support			0	0
Reimbursement agreements			0	0
Training: Training grants	4*	9		
Fellowships	0*	0		
Total			4*	9
Research Career Development Awards			0*	0
New and Academic Investigator Awards			1*	43
Subtotal - Extramural				$ 1,047
Intramural				
Projects			0	0
Training			0*	0
Subtotal - Intramural				$ 0
TOTAL NUTRITION RESEARCH AND TRAINING - NIAID				$ 1,047

*Number of persons.

Table F-6

National Institute of Arthritis, Metabolism, and Digestive Diseases
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1980
(in thousands of dollars)

Item	Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural				
Research grants: Regular	435	$19,504		
Clinical trials	1	0		
Total			436	$19,504
Program projects: Regular	11	2,503		
Clinical trials	0	0		
Total			11	2,503
Contracts: Regular	2	222		
Clinical trials	0	0		
Total			2	222
Centers: Regular	6	1,546		
Clinical trials	0	0		
Total			6	1,546
Research support			0	0
Reimbursement agreements			0	0
Training: Training grants	68*	814		
Fellowships	26*	305		
Total			94*	1,119
Research Career Development Awards			11*	344
New and Academic Investigator Awards			3*	86
Subtotal - Extramural				$25,324
Intramural				
Projects			5	1,026
Training			7*	107
Subtotal - Intramural				$ 1,133
TOTAL NUTRITION RESEARCH AND TRAINING - NIAMDD				$26,457

*Number of persons.

Table F-7

National Institute of Child Health and Human Development
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1980
(in thousands of dollars)

Item		Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural					
Research grants:	Regular	148	$11,465		
	Clinical trials	8	585		
	Total			156	$12,050
Program projects:	Regular	13	3,844		
	Clinical trials	4	328		
	Total			17	4,172
Contracts:	Regular	8	715		
	Clinical trials	2	19		
	Total			10	734
Centers:	Regular	7	655		
	Clinical trials	1	12		
	Total			8	667
Research support				2	50
Reimbursement agreements				1	5
Training:	Training grants	8*	248		
	Fellowships	8*	138		
	Total			16*	387
Research Career Development Awards				10*	247
New and Academic Investigator Awards				0*	0
Subtotal - Extramural					$18,312
Intramural					
Projects				10	1,790
Training				7*	308
Subtotal - Intramural					$ 2,098
TOTAL NUTRITION RESEARCH AND TRAINING - NICHD					$20,410

*Number of persons.

Table F-8

National Institute of Dental Research
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1980
(in thousands of dollars)

Item		Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural					
Research grants:	Regular	13	$ 702		
	Clinical trials	0	0		
	Total			13	$ 702
Program projects:	Regular	1	71		
	Clinical trials	0	0		
	Total			1	71
Contracts:	Regular	3	244		
	Clinical trials	0	0		
	Total			3	244
Centers:	Regular	1	228		
	Clinical trials	0	0		
	Total			1	228
Research support				0	0
Reimbursement agreements				0	0
Training:	Training grants	8*	150		
	Fellowships	1*	18		
	Total			9*	168
Research Career Development Awards				2*	70
New and Academic Investigator Awards				3*	80
Subtotal - Extramural					$ 1,563
Intramural					
Projects				7	85
Training				0*	0
Subtotal - Intramural					$ 85
TOTAL NUTRITION RESEARCH AND TRAINING - NIDR					$ 1,648

*Number of persons.

Table F-9

National Institute of Environmental Health Sciences
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1980
(in thousands of dollars)

Item		Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural					
Research grants:	Regular	37	$1,884		
	Clinical trials	0	0		
	Total			37	$ 1,884
Program projects:	Regular	4	693		
	Clinical trials	0	0		
	Total			4	693
Contracts:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Centers:	Regular	6	756		
	Clinical trials	0	0		
	Total			6	756
Research support				0	0
Reimbursement agreements				0	0
Training:	Training grants	18*	167		
	Fellowships	0*	0		
	Total			18*	167
Research Career Development Awards				0*	0
New and Academic Investigator Awards				6*	186
Subtotal - Extramural					$ 3,686
Intramural					
Projects				1	200
Training				0	0
Subtotal - Intramural					$ 200
TOTAL NUTRITION RESEARCH AND TRAINING - NIEHS					$ 3,886

*Number of persons.

Table F-10

National Institute of General Medical Sciences
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1980
(in thousands of dollars)

Item		Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural					
Research grants:	Regular	12	$ 889		
	Clinical trials	0	0		
	Total			12	$ 889
Program projects:	Regular	3	483		
	Clinical trials	0	0		
	Total			3	483
Contracts:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Centers:	Regular	3	519		
	Clinical trials	0	0		
	Total			3	520
Research support				0	0
Reimbursement agreements				0	0
Training:	Training grants	93*	432		
	Fellowships	2*	13		
	Total			95*	445
Research Career Development Awards				2*	75
New and Academic Investigator Awards				1*	39
Subtotal - Extramural					$ 2,451
Intramural					
Projects				0	0
Training				0*	0
Subtotal - Intramural				0	0
TOTAL NUTRITION RESEARCH AND TRAINING - NIGMS					$ 2,451

*Number of persons.

Table F-11

National Institute of Neurological and Communicative Disorders and Stroke
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1980
(in thousands of dollars)

Item		Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural					
Research grants:	Regular	30	$ 1,208		
	Clinical trials	1	127		
	Total			31	$ 1,335
Program projects:	Regular	1	334		
	Clinical trials	1	625		
	Total			2	959
Contracts:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Centers:	Regular	1	488		
	Clinical trials	1	55		
	Total			2	543
Research support				0	0
Reimbursement agreements				0	0
Training:	Training grants	0*	0		
	Fellowships	0*	0		
	Total			0*	0
Research Career Development Awards				0*	0
New, Young, and Academic Investigator Awards				0*	0
Subtotal - Extramural					$ 2,837
Intramural					
Projects				0	0
Training				0*	0
Subtotal - Intramural					$ 0
TOTAL NUTRITION RESEARCH AND TRAINING - NINCDS					$ 2,837

*Number of persons.

Table F-12

Division of Research Resources
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1980
(in thousands of dollars)

Item	Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural				
Research grants: Regular	1	$ 59		
Clinical trials	0	0		
Total			1	$ 59
Program projects: Regular	0	0		
Clinical trials	0	0		
Total			0	0
Contracts: Regular	0	0		
Clinical trials	0	0		
Total			0	0
Centers: Regular	22	839		
Clinical trials	0	0		
Total			22	839
Research support			243	10,231**
Reimbursement agreements				0
Training: Training grants	0*	0		
Fellowships	0*	0		
Total			0*	0
Research Career Development Awards			0*	0
New and Academic Investigator Awards			0*	0
Subtotal - Extramural				$ 11,129
Intramural				
Projects			0	0
Training			0*	0
Subtotal - Intramural				$ 0
TOTAL NUTRITION RESEARCH AND TRAINING - DRR				$ 11,129

*Number of persons
**A percentage of this is clinical trials

APPENDIX G

MISSION STATEMENTS IN NUTRITION
BY INSTITUTE AND DRR

Biomedical nutrition research supported by the NIH encompasses the role of nutrients on human growth and development, health maintenance and promotion, disease prevention, and disease treatment. The specific mission statements in nutrition for the individual Institutes and the Division of Research Resources are the following:

NATIONAL CANCER INSTITUTE

The NCI supports extensive research on the relationship between cancer and nutrition in a wide variety of areas: basic cellular mechanics, etiology, prevention, epidemiology, therapy, rehabilitation, research development, and information dissemination. Each of the Divisions of the NCI, including the Office of the Director, funds a significant number of projects in nutrition and cancer research.

Resource development projects funded through the NCI's Office of the Director aim toward developing and standardizing new and more accurate methods of determining nutritional status.

The Division of Cancer Biology and Diagnosis supports basic research into the manner in which cell growth, differentiation, function, and transformation are affected by the absence or excess of various dietary factors, as well as the nutrient requirements of various types of neoplastic cells.

Through the Division of Cancer Cause and Prevention, the NCI funds a large number of nutrition and cancer epidemiology studies, along with studies that: investigate dietary components to determine if they can act as promoters or inhibitors of carcinogenesis; test the use of nutrients and/or their analogs in cancer prevention among high-risk groups; and attempt to identify and ameliorate the effect of naturally occurring dietary components, which can act as mutagens and carcinogens.

Research supported by the Division of Cancer Treatment is directed toward the determination of whether nutritional support before or during various forms of cancer therapy can alleviate the side-effects of such therapy, allow more intensive therapy to be given, and improve the quality of life of cancer patients both during and after therapy. Additional studies are conducted to determine if dietary manipulation can be used to slow tumor growth, to identify the causes of anorexia, and to develop methods to prevent or alleviate the anorexia that severely compromises the survival of patients with cancer.

The Division of Cancer Control and Rehabilitation focuses on projects that aid the cancer patient in the recovery process. Such projects include the development of prostheses that allow for more adequate nutrient intake, digestion, and absorption, as well as projects to determine the best types and routes of nutrient intake during the rehabilitation process.

NATIONAL EYE INSTITUTE

Of particular interest to the NEI is the role of vitamin A in the development and functioning of the retina and cornea. The NEI's research interests include not only the role of vitamin A in normal ocular physiology but also how vitamin A relates to the blinding condition, keratomalacia, that is so prevalent in Central America, the South Pacific, the Indian subcontinent, and in other parts of the world. As research produces more knowledge about how vitamin A is handled in protein/calorie-deficient children and others who have been subjected to inadequate diets, it should be possible to design and evaluate--first in a clinical situation and ultimately under field test conditions--new approaches to vitamin A and protein supplementation that may prevent or at least reduce the severity of nutritional blindness. Toward this end, the NEI is actively collaborating with other Government agencies as well as the International Agency for the Prevention of Blindness, Helen Keller International, the World Health Organization and its affiliates, and other groups that are committed to improving public health throughout the world.

NATIONAL HEART, LUNG, AND BLOOD INSTITUTE

The NHLBI supports investigation on the social, environmental, behavioral nutritional, biological and genetic determinants and influences on the epidemiology, etiology, and prevention of all forms and aspects of heart, blood vessel, lung, and blood diseases.

Special emphasis is placed upon dissemination of information regarding diet, exercise, stress, cigarette smoking, and weight control.

NATIONAL INSTITUTE ON AGING

The NIA conducts nutrition research to: 1) better understand the nutritional requirements of the elderly; 2) determine relationships between nutrition and age, health, and disease; and 3) relate nutritional status to a variety of physical and biochemical variables influenced by age. With this program, the NIA intends to build the first comprehensive body of new knowledge on dietary intake, nutrient utilization, nutritional status, and the influence of these factors on the promotion and maintenance of optimal health in the aged. The results of such research will not only complement the research efforts of other Institutes in the area of nutritional influences as risk factors or contributors to disease states, but will also contribute greatly to the enhanced well-being of older Americans.

NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

The NIAID is interested in promoting and supporting research in the broad field of nutrition, infection, and immunity. Specific interests focus on the modulating effect of specific nutrients on basic immune functions,

food allergies, and immune response to ingested antigens; the interactions of nutrition and infection in the tropical environment and in American hospitals; and the modulating effect of specific nutrients on microbial virulence.

NATIONAL INSTITUTE OF ARTHRITIS, METABOLISM, AND DIGESTIVE DISEASES

The nutrition program at the NIAMDD supports research and training in basic and clinical nutrition. It promotes research to advance knowledge about the functions and requirements of nutrients in the body, the relationships of diet and nutrients to health and disease, and the prevention and treatment of disease through the application of this knowledge. The NIAMDD emphasizes the following nutrition research areas: obesity, supportive nutrition, nutritional anemias, trace element nutrition, dietary fiber, metabolism and mechanism of action and interaction of nutrients, and factors that modify nutrition requirements.

Other programs--especially Diabetes, Metabolism, Digestive Diseases, Hematology, and Orthopedics--support nutrition research as it relates to these areas.

NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT

The nutrition component of the mission of the NICHD is to advance knowledge on the role of nutrients in the promotion of health and well-being and the prevention and treatment of disease and disability.

The NICHD conducts and supports research and research training in nutrition as related to reproduction, pregnancy, infancy, childhood, and adolescence. Specifically, the NICHD seeks to determine the roles played by nutrition in: fertility and infertility; fetal development; maternal-infant relationships; and infant, child, and adolescent development.

Research is supported to develop new knowledge on nutritional deficiencies that may serve to predict disease and disability; interventions that may be applied to prevent and treat nutrition-related problems in utero, at birth, and in early life; optimal nutrient requirements for pregnant women and for infants; and the specific roles played by nutrients during growth and development, both physical and psychological.

The NICHD program of biomedical and behavioral research in nutrition emphasizes studies on developmental gastroenterology; childhood antecedents of adult disease; genetic-nutritional-environmental interactions; optimal maternal nutrition during pregnancy; the effects of infant feeding practices and infant nutrition on subsequent physiological, immunological, and personal development; and social and behavioral influences in childhood that may affect dietary and nutritional patterns throughout life.

NATIONAL INSTITUTE OF DENTAL RESEARCH

The mission of the NIDR in the area of nutrition is to improve the general oral health of the American population by reducing the severity of dental caries, periodontal disease, and other conditions of the oral-facial complex that are affected by various aspects of nutrition and diet. This mission is carried out through several approaches: 1) the conduct of basic research with emphasis on the systemic effects of nutrients as they relate to oral structures; 2) applied research that includes the study of the nature and composition of the diet, its local or topical effects, and its ultimate contribution to the prevention or reduction in severity of dental caries and periodontal disease; 3) training of individuals to participate in and/or conduct research as it relates to oral health; 4) demonstration projects that include identifying and developing agents and techniques to prevent dental caries and to promote the widespread acceptance and use of such agents and techniques by the public; and 5) the dissemination of available information to the public via various modes of communication.

NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES

The NIEHS is responsible for research on those chemicals comprising constituents of food that are pertinent to food safety and human health. These can be divided into two groups: 1) those present as naturally occurring components or contaminants; and 2) those added by man directly or indirectly in the course of food manufacturing, preparation, or during production (plants/animals).

NATIONAL INSTITUTE OF GENERAL MEDICAL SCIENCES

The NIGMS supports nutrition research directed to the discovery of better ways to prevent death from injury, mitigate pain, speed recovery of patients, and lessen the extent of disabilities caused by injuries. A better understanding of the total body response to trauma, including burns, is sought. This includes the biochemical and physiological changes induced by trauma and the fundamental aspects of wound healing and biological repair. Emphasis is given to nutrition research as it relates to treatment of post-traumatic infections, to the nutritional requirements of patients with burns, and to the rehabilitation of injured patients.

NATIONAL INSTITUTE OF NEUROLOGICAL AND COMMUNICATIVE DISORDERS AND STROKE

The NINCDS is responsible for studying and clarifying the two-way interaction between nutrient intake and activity of the central nervous system. The Institute's specific interests include the neural control of food intake; the enteral and parenteral factors that influence the onset or progress of neurological disorders; the metabolic effect of food and chemical substances on hereditary metabolic disorders that cause neurological abnormalities; the effects of protein and vitamin deprivation

during fetal development and throughout life; the mechanisms to improve the transport of nutrients and drugs across the blood brain and blood cerebrospinal fluid barriers; and the peripheral effects on nutrition of drugs used in central nervous system disorders.

DIVISION OF RESEARCH RESOURCES

Through its General Clinical Research Centers Program, the DRR supports research facilities, laboratories, professionals, nursing and dietary personnel essential to clinical investigation in nutrition. The General Clinical Research Centers (GCRCs) throughout the United States provide an effective resource for the interdisciplinary approach to study the clinical manifestations of American dietary patterns. The scope of nutrition research in the GCRCs includes obesity, diabetes, cancer, parenteral nutrition, hyperlipidemias, atherosclerosis, vitamins, and environmental health factors. Because of this large variety of projects, the GCRCs are instrumental in the integration of many disparate avenues of research resulting in the most effective methodology of health care. The General Centers relate to categorical centers for research in hypertension, diabetes, and cancer.

The team approach in clinical investigation allows the basic scientist, clinician, dietitian, and nurse to interact in developing a systematic methodology for nutrition research.

APPENDIX H

LEGISLATIVE AUTHORITY OF NIH FOR HUMAN NUTRITION RESEARCH

Two Institutes have specific mandates to conduct nutrition research at the NIH. Those mandates are as follows (references are to PHS Act):

NCI: Section 407(b)(4)--"Collect, analyze, and disseminate information (including information respecting nutrition programs for cancer patients and the relationship between nutrition and cancer) useful in the prevention, diagnosis, and treatment of cancer, including . . ."

NHLBI: Section 413(a)(1)--"investigation into the epidemiology, etiology, and prevention of all forms and aspects of heart, blood vessel, lung, and blood diseases, including investigations into the social, environmental, behavioral, nutritional, biological, and genetic determinants and influences . . ."

Section 413(d)--"There shall be in the Institute an Assistant Director for Prevention, Education and Control . . . In the conduct of such a program, special emphasis shall be placed upon dissemination of information regarding diet, exercise, stress, cigarette smoking, weight control . . ."

Other Institutes that conduct and support nutrition research do so under much broader authority. Each conducts research programs in the "diagnosis, prevention, and treatment" of specific diseases and life processes within their areas of responsibility. Those authorities are as follows:

General authority	Section 301
International cooperation authority	Section 307
Training authority	Section 472(a)(1)(a)
NCI	Section 402(a)
NHLBI	Section 412(1)
NIDR	Section 422(a)
NIAMDD	Section 434(c) Section 435(a) Section 439(a)
NICHD	Section 441(a)
NIGMS	Section 442
NIA	Section 464
Other Institutes	Section 431(b)

NCI LEGISLATIVE AUTHORITY FOR NUTRITION INFORMATION AND EDUCATION PROGRAMS

The specific mandates of the NCI for nutrition information and education programs are contained in Section 407(b)(4) of Public Law 92-218, "The National Cancer Act of 1971," as amended in Public Law 93-352, "Title I - Extension of Cancer Program":

> P.L. 92-218, Section 407(b)(4): "Collect, analyze, and disseminate all data useful in the prevention, diagnosis, and treatment of cancer, including the establishment of an international cancer research data bank to collect, catalog, store, and disseminate insofar as feasible the results of cancer research undertaken in any country for the use of any person involved in cancer research in any country."
>
> P.L. 93-352, Section 103: "Section 407(b)(4) of the Public Health Service Act is amended by striking out 'all data' and inserting in lieu thereof 'information (including information respecting nutrition programs for cancer patients and the relationship between nutrition and cancer).'"

NHLBI LEGISLATIVE AUTHORITY FOR NUTRITION INFORMATION AND EDUCATION PROGRAMS

The specific mandates of the NHLBI for nutrition information and education programs can be found in Section 413 of the Public Health Service Act, March 1977. This Section indicates the general plan for the Institute to expand, intensify, and coordinate the Institute's activities in the areas of heart, blood vessel, lung, and blood diseases and blood resources. To implement this mandate, Section 413(a)(1) states:

> "Investigation into the epidemiology, etiology, and prevention of all forms and aspects of heart, blood vessel, lung, and blood diseases, including investigations into the social, environmental behavioral, nutritional, biological, and genetic determinants and influences involved in the epidemiology, etiology, and prevention of such diseases."

Section 413(d) states the following:

> "There shall be in the Institute an Assistant Director for Prevention, Education, and Control who shall be appointed by the Director of the Institute. The Director of the Institute, acting through the Assistant Director for Prevention, Education, and Control, shall conduct a program to provide the public and the health professions with health information with regard to cardiovascular and blood and pulmonary diseases and blood resources. In the conduct of such program, special emphasis shall be placed upon dissemination of information regarding diet, exercise, stress, hypertension, cigarette smoking, weight control, and other factors affecting the prevention of arteriosclerosis and other cardiovascular diseases and of pulmonary and blood diseases."

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